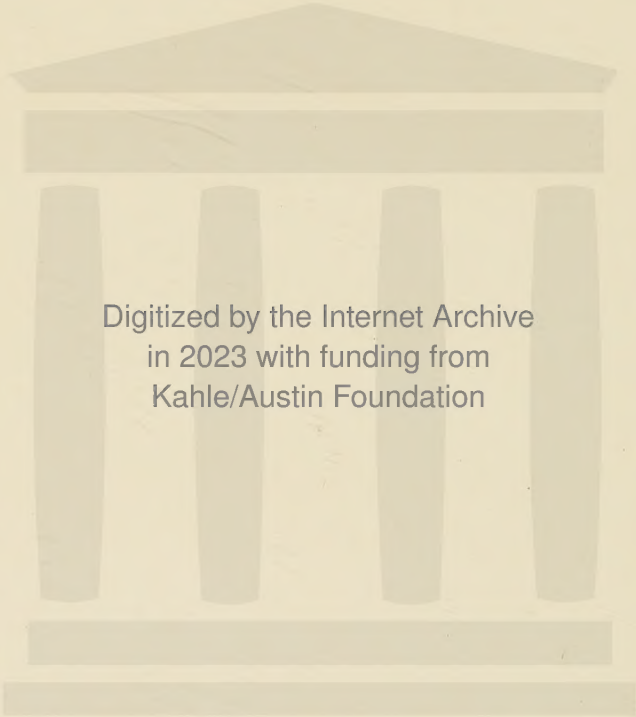
ROUND THE YEAR

With Enid Blyton

H. Hadwen



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SPRING TIME

THIS TINY LAMB FEELS SAFE WITH THE FRIENDLY SHEEPDOG

ROUND THE YEAR

WITH

ENID BLYTON

SPRING TIME

EVANS BROTHERS LIMITED, LONDON

ENID BLYTON'S NATURE BOOKS

ROUND THE YEAR WITH ENID BLYTON

A YEAR'S NATURE STUDY IN FOUR BOOKS

SPRING

SUMMER

AUTUMN

WINTER

In addition to the seasonal books, there is a library edition, containing the four books under one cover, bound in cloth boards

LONDON

EVANS BROTHERS LIMITED

MONTAGUE HOUSE, RUSSELL SQ., W.C.1

GREEN HEDGES,
PENN ROAD,
BEACONSFIELD,
BUCKS.

DEAR BOYS AND GIRLS,

I wish you could come with me and walk over the hills, through the fields, and down by the river, finding a hundred exciting or beautiful things by the way. I should like to take you fishing in the ponds, and fill your jars with snails and tadpoles. I should like to help you to make a fine bird-table, or to prepare a splendid aquarium. I should like to give you a garden of your own, and show you how to make it a place of bright colours and sweet scents.

But I cannot do all these things—so instead I have written these four books for you, so that you may read them and do for yourselves all the things I would like to do with you. We will go round the year together, and you must discover with your teacher and your friends all the exciting things there are to be found in Nature study.

Good luck to you in all your Nature work, and may you find as much delight in using these books as I found when writing them for you !

Enid Blyton

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CHAPTER 1

NATURE CHARTS

FOR a whole year you and I are going to look at Nature together. We are going to study the weather, the plants and trees, the animals and insects, and the birds, and we are going to *do* things as well as learn things. You will have to look for things, make things, watch for birds and flowers, and use your eyes and ears as keenly as a hare does. And if, at the end of the year, you can say, " Well, I *do* love going for walks, there's so much to see and hear ! " or " What a lot of things there are to know and enjoy ! " I shall know you have done your part.

There is something that is always with us, day in and day out—and that is the weather. No matter where our home or school is, in the heart of a town or in the depths of the country, we all have the weather. Everything in Nature depends on the weather—a warm spring means early flowers and early tadpoles. A bitter winter means frozen birds and starving rabbits. The weather decides what we see around us in Nature, and for that reason we must notice it every day, and make a record of it.

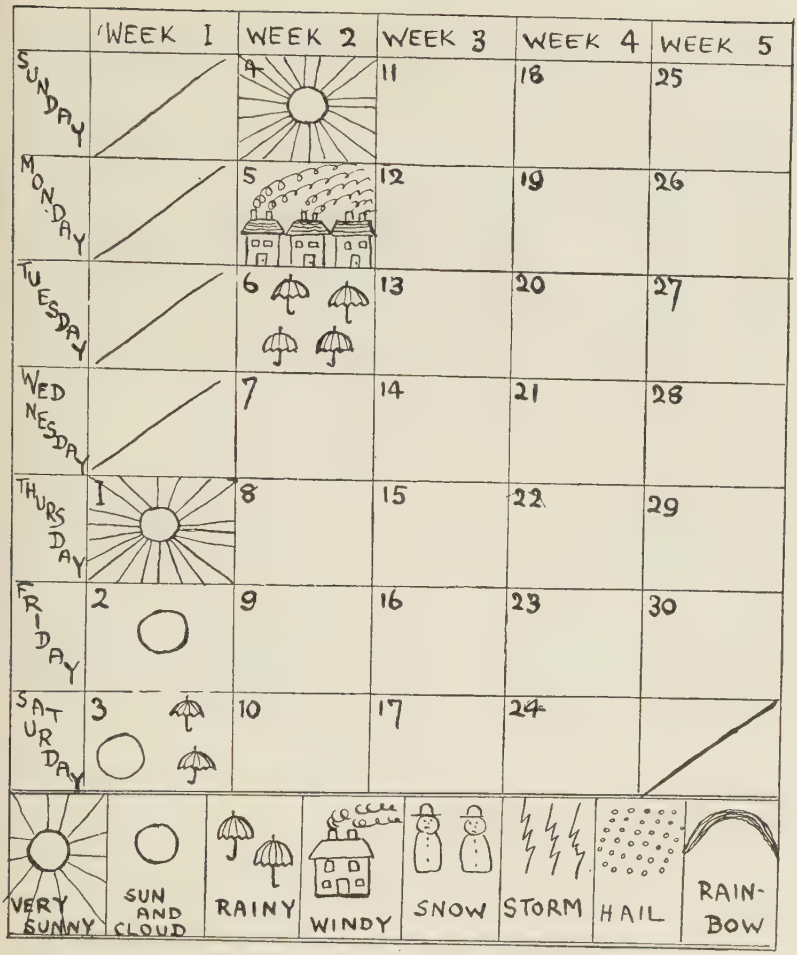
Many of you will have kept weather charts before,

probably weekly ones. We will keep a monthly one, because some of the other records and calendars we shall make will be monthly too. Think of all the different kinds of weather we have and make a list of them. How many can you think of? Sunny weather, rainy weather, wind, snow, hail, lightning, rainbows, and so on will appear on your lists—and sooner or later all of them will have to be entered on our charts.

Now we will make the first monthly chart. You will want a large sheet of stiff drawing or painting paper. At the top in big clear letters your best letterer must put "Weather Chart for . . ." followed by the month and the year. Then you will want four headings, or five, if the month runs, as it generally does, into a fifth week—1st week, 2nd week, 3rd week, 4th week, 5th week. Down the left-hand side put the names of the seven days of the week.

It is dull to write "Hot and sunny" or "Cold and frosty" on our charts, and besides we could not see from our seats what the weather had been like for the week or month, if the record was kept in writing. So we will choose signs or symbols to record our weather for us. At the bottom of the chart we will draw and colour these symbols to remind us what they mean, and use them each day when we fill in the weather.

What will you choose for rainy weather? Slanting lines of rain in blue chalk, open umbrellas, Wellington



A WEATHER CHART

Here is part of a weather chart being kept by a class. Yours will look rather like this. Make it as large as you can, so that everyone can see it easily.

boots? It does not matter a bit—choose what seems the most interesting to you. What will you have for sunshine? A bright red sun with yellow rays? A yellow sun without rays for a sunny, but rather cloudy day? Or would you like sunshades for very hot days?

Hail could be little round balls in slanting lines. When you have chosen all you wish, draw your symbols neatly at the bottom of the chart. Look at the chart illustrated, and you will see what I mean. If you can draw or paint well, you might decorate the chart at the top or sides.

Now all you have to do is to enter the weather each day. You must make a new chart every month, of course, and at the end of the year you can string them together and use them next year to compare with future weather.

Shepherds and farmers are often very good at foretelling the weather. They are so used to studying the sky and the wind that they know when to expect rain and when to expect sun. Some of their knowledge you will find in weather proverbs and sayings, such as "A red sky at night is the shepherd's delight; but red sky in morning is the shepherd's warning."

The weather is so important to farmers, seamen and airmen that a great deal of attention is now paid to correct forecasting. You have probably heard the weather forecast over the wireless, or heard your

AIR-PILOTS BEING TOLD WHAT WEATHER THEY MAY EXPECT ON THEIR COMING FLIGHT

father read it out of his morning paper, and have wondered how people know what the weather is going to be. You would be surprised at the great number of specially trained observers in all parts of the country, and on ocean-going ships, whose business it is to make notes of such things as rainfall, force and direction of the wind, the dampness, pressure and warmth of the

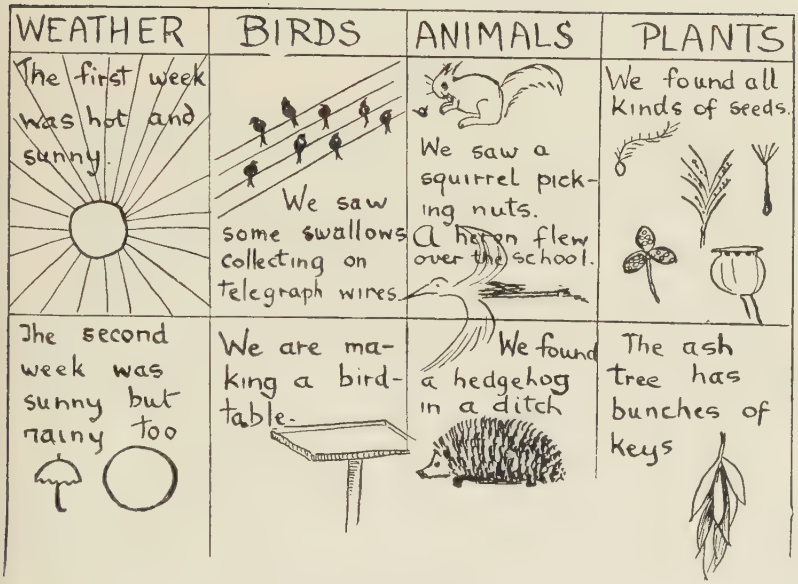
air, and so on. They send their results by wireless or telegram to their headquarters, the Meteorological Office, and all the information is then carefully studied and the weather forecast made.

Airmen always study weather forecasts carefully. They want to know such things as strength and direction of winds, and these are found out for them by means of special kites and balloons sent up at various heights in different parts of the country.

And now I think you will understand how very important the study of the weather is, and will fill in your weather chart regularly.

There is another chart we ought to make, too—a record of the happenings in Nature week by week. This must be quite a big chart because there may be many things to put on it. We can have either four columns or three—four if you include a column for weather for the week, which I should certainly do. Head your chart "Nature Calendar for . . . . . ." Then make four section-headings, Weather, Animals, Birds, Plants. Then, each week, enter into the space beneath each heading what you have noticed for that week.

Look at the section of a Nature chart on the next page, and you will see the sort of thing you should do. You can either draw straight on the chart itself or you can draw and colour the things separately, and



A NATURE CALENDAR

the best can be cut out and pasted on. You will find that this chart soon begins to look very exciting, and will be visited by many children from other classes! Be sure to keep it, when finished, to compare with next year's chart.

THINGS TO DO

1. Write down what you remember of yesterday's weather.
2. Make a list of all the different kinds of weather you can think of.
3. Begin a collection of Weather Proverbs and Sayings.

CHAPTER 2

SOME WAYS OF GROWING SEEDS

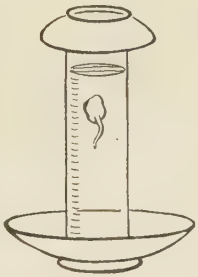
NOW I am going to tell you a good many different ways of growing seeds, so that you may watch them developing all the time. I expect most of you have already grown seeds in one or other of the ways, so I will give you a wide choice, and you can choose some of the experiments you have not tried before, leaving out the ones you already know.

There are many different seeds you may use for germinating experiments. You have probably tried the Bean, Maize, Pea, and Mustard and Cress. You can also grow Buckwheat, Sunflower, Marrow, Sweet-Pea, Sycamore, Onion, Grass, Lupin, and, of course, acorns and chestnuts in the glasses that are specially made for them. Do not stop at these seeds or fruits—gather seeds from the woods, and germinate those too. Gather them from the fields and grow little wild plants next spring! Save your date stones, and your apple and orange pips and grow those too.

You all know how a seed grows—first a root, and then a little green shoot—because you have planted seeds in your garden or in your window-box. It would be fun to *see* its root growing out and its shoot growing

up, so you can try this experiment. It is quite an ordinary one, and if you already know it try another.

You will want a glass lamp chimney, cylindrical in shape, a saucer and a piece of clean blotting-paper. Cut the blotting-paper so that it exactly fits round the lamp glass inside. Slip it in. Stand the chimney in a saucer of water. Do you see how the blotting-paper is soaking up the water? When it gets halfway it may be very slow in getting further, so just turn the chimney upside down, and let the other half soak up quickly.

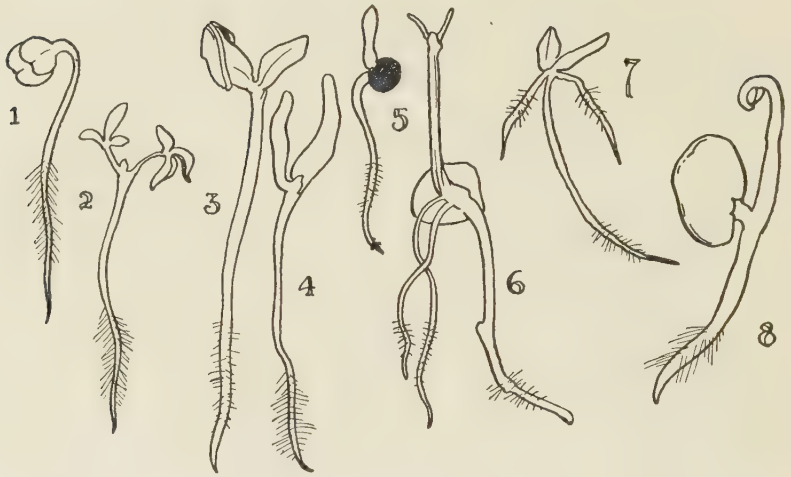


Now take some beans, which you have soaked for twenty-four hours, and slip them in between the blotting-paper and the glass. Put a little saucer or slip of glass on top of the chimney to keep the moisture in, and your experiment has begun.

Now you may easily watch the bean put out its root and its shoot, and see it grow. Draw it as it develops. You will find it very interesting.

You may grow other big seeds, such as the pea, in this way.

You will notice that I asked you to use *soaked* beans. Do you know why? It is because then they are in a fit state to grow. Look at a dry bean from the garden,



SEEDS FOR YOU TO GROW

1. MUSTARD SEEDLING. 2. CRESS SEEDLING. 3. SUNFLOWER SEEDLING (note fruit-coat being cast off). 4. SYCAMORE SEEDLING. 5. PEA SEEDLING. 6. MAIZE SEEDLING. 7. WHEAT SEEDLING. 8. BEAN SEEDLING.

or from the bean-bag. Isn't it hard and small, compared with a soaked one?

Did you see the beans as they were soaking? If you did you will have noticed that the skin wrinkled very much at first, and then gradually smoothed out as the bean itself took in water and swelled. Take up a soaked bean. Squeeze it. Did you see a tiny drop of water come out of a small hole at one side? Look at the little hole. It is through there that most of the water was taken up. Would you like to prove

that? Very well, we will go on to another experiment.

For this we shall want two large flat corks. Take about ten beans and divide them into two equal heaps. Weigh each heap and write down their weight. Put each lot of beans on their corks, and slip a rubber band across them to hold them in place. See that one lot of beans is placed with the little holes in the seed-coats uppermost, out of the water. In the others let them be downwards so that they touch the water when the corks are floated in saucers or jars with their burden of beans.

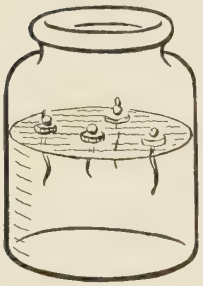
Leave your beans for 48 hours and then remove them from their corks. Wipe them carefully and re-weigh each separate lot of beans. The batch that had their little holes touching the water will weigh more than the others. Why?

You can easily prepare a germination jar for almost any kind of seed. Get a glass jam-jar with a nice wide mouth. Cut a piece of clean blotting-paper to fit the inside of it neatly. Now get some sawdust and fill up the jar. It will press hard against the blotting-paper and keep it close against the glass. Next get some water and pour in enough to wet the sawdust and keep the blotting-paper moist. Then you may put your

seeds between the paper and the glass, and watch them grow daily. The dampness from the blotting-paper gives them the moisture they need.

It is fun to put various different seeds into this germination jar, and watch how differently they grow. Would you like to do that? Draw them as they develop.

Here is a little experiment you may like to make with a few peas. Get some small corks—or cut a long cork into two or three pieces—and bore a neat hole in each one. Now put your peas one on each cork, just over the hole, and float them in a jar of water. Roots need water, and you will see your little peas putting their roots through the hole in the corks to reach the water down below! The shoot will grow upwards, of course.

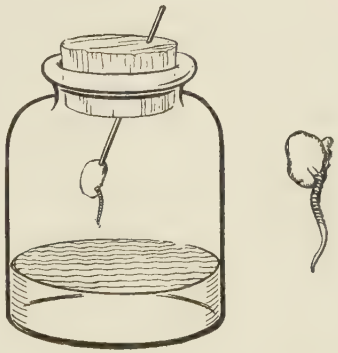


The next experiment will show the whole development of a germinating seed very clearly. For this you need a wide-mouthed glass jar again and a cork to fit it. Make a hole in the cork and pass through it a knitting-needle (or long darning-needle will do). Push a soaked bean on to the end of the needle. Now put the cork in the bottle so that the bean hangs in mid-air inside the bottle, over about an inch or so of water. The water keeps the air moist enough for the bean to

germinate, and you will see it sending out root and shoot in a most interesting fashion.

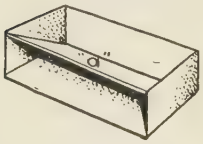
As you watch a seedling developing and see the root growing longer and longer, perhaps you wonder which bit of the root is the growing part. Shall we find out? It is quite easy to do so.

For this we shall want a bean that has a root about an inch long. One that has grown on a knitting-needle in our glass jar will do very well. Take it out and wipe it *very* carefully. Now get a bit of cotton or silk and, holding it at each end, dip the middle of it into the ink-pot. Draw the inky part across the root at the top, making a clear little mark. Now do it again a short distance above, then again and again until the whole root is marked evenly from bottom to top. Now place it carefully in your jar again.



Now you must make a careful drawing of the root, showing on it the exact number of lines, all evenly spaced. Make another drawing in forty-eight hours—and you will have found out which part of the root grows! There will be a piece of root behind the tip which has no marks at all—and that is the piece that

has grown, and so made the whole root longer! Isn't that interesting? You will be able to see this happening, if you look at the marked bean's root carefully about every three hours.



It is useful to make a germinating box for seeds. This is how you do it. Get an ordinary wooden box without a lid. Take one side off, and get a sheet of glass to put in it slantways—*i.e.*, the glass should slant in to the further corners, instead of being vertical as the removed side was. You can tack in two little strips of wood to keep the glass in place. Fill the glass-sided box with damp coconut-fibre or with damp sawdust, then put in your seeds, about an inch or so below the surface, resting on the slanting glass. You can then watch them germinating.

Mustard and cress are good seeds to grow because they germinate so quickly. We must really have some of them. How shall we grow them?

Well, you may scatter them in the holes of a damp sponge and let them grow there; or you may grow them on moist blotting-paper or on a piece of wet flannel.

Another way to grow mustard seeds is to soak them well, and then press them against the inside of a wet flower-pot. They will stick there. Turn the pot upside-down gently and stand it in a saucer of water. Examine the seeds in a few days. You will see that

they have sent out long roots, and you will find on the roots some beautiful silky root-hairs. Hold them up to the light and see how fine they are.

It is these root-hairs that drink up the moisture which helps the baby-plant to live. All roots have them, and we might almost call them root-mouths. They fasten themselves to the earth, when they are in the ground, and when we pull up a plant we break these root-hairs. Then the root has to grow new "mouths," and the plant may suffer. So when we move plants we must try to see that they have a ball of earth round their roots, so that the root-hairs may not be broken.

Soak some fir-cones. Shake a few grass seeds or other small seeds behind the brown scales. They will grow out and cover the cone with green.

Acorns and chestnuts are such big seeds that they are splendid for germination purposes. Grow them in the specially made glasses sold for this purpose. If these are not obtainable grow them in the necks of bottles.

Grow the seeds of as many trees as you can. Ash, plane, sycamore, beech, Scots fir, hazel, holly, and so on, will all germinate. Remember to collect as many as possible in the autumn for use in the spring. They

DEVELOPMENT OF A GORSE SEEDLING. GROW ONE OF THESE AND SEE HOW SOME OF THE LEAVES GROW INTO THORNS

DEVELOPMENT OF A SYCAMORE SEEDLING

will keep well if stored in sand. Everything may be tried—it is surprising what good results can be had with apple-pips, for instance, or date-stones. The seeds of tropical trees should be started in a warm place, and when the shoot develops, which may be after some long

while, the little tree should be kept indoors, not planted outside.

All germinated seeds may be planted out in the garden when finished with. Peas and beans may provide a nice crop, even if only grown in a flower-pot !

THINGS TO DO

1. Choose which experiments you are going to make, and keep an account of them on a chart by notes and drawings.
2. Grow a bean seed and a sunflower seed in a pot of earth. Notice how differently they grow.
3. See if you can find some ivy berries. Grow them in a pot. Keep the earth damp but not too wet.
4. Write down what root-hairs do.

CHAPTER 3

THE WIND AND ITS WORK

IS it a windy day? I do hope it is, because I am going to talk to you about the wind and its work—and if you can see through the windows what the wind is doing, it will be a great help.

I expect you have often wondered what made the wind come. Where does a wind begin? It must begin *some*where, mustn't it! The wind is rather mysterious, I always think. We can never see it—we can only see the things it does and feel it as it goes by.

How do you know when there is a wind? Think of all the things that tell you. We see the trees waving their branches about, we see the chimney smoke being twisted here and there, the flags flutter, the weather-cock moves, the clothes on the line dance wildly, and the grass all bends one way. We *feel* the wind, too—it blows cold on our cheeks and it takes our breath away if it is very strong.

What *is* a wind? Who knows? Take up a book and wave it up and down in front of your face. You have made a little wind, haven't you? You can feel it cold against your face. You can tell what it is now—just a patch of moving air. Even the biggest winds

are nothing more than that—air that is moving about. It is very difficult to say where a wind begins, but we know *why* it begins. When air is heated over any place it becomes lighter than the colder, denser air round about; the cold air rushes in and pushes the warm light air before it. When we feel the cold air rushing in we say, "How windy it is!" The current of cold air has made a wind, which we feel on our faces, and which we see stirring the trees.

When you have been to the seaside have you noticed that in the daytime there is usually a breeze blowing up the beach from off the sea? What makes that sea-breeze?

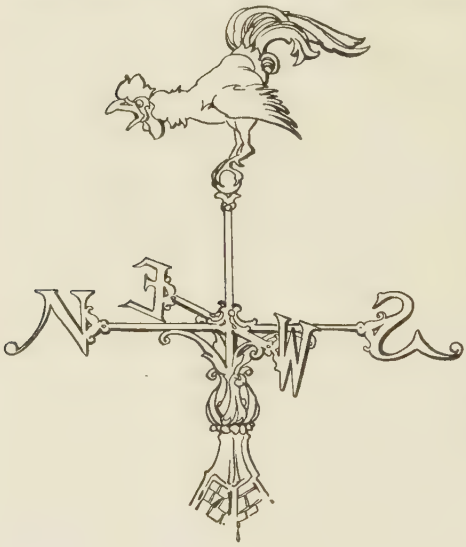
In the daytime the land gets hot more quickly than the sea does, and the *air* over the land gets warm, too. The hot air is pushed away by a rush of cool air over the land from the sea, forcing up the hot air and making a stiff "sea-breeze."

But when evening comes exactly the opposite happens. The sea-breeze dies away and a wind rises over the land and blows seawards. Why is that?

It is because the sea takes longer to cool than the land does, at night, and the air over the sea is warmer then than the air over the land. So when the hot sea air is forced upwards by a rush of colder air from the land we say, in surprise, "Oh, there's a breeze off the *land* to-night! All day it was off the sea!"

We call these winds land- and sea-breezes, and I have told you about them because they will show you how a wind may begin.

I wonder if you have a weather-cock or weather-vane near your school or home that you have often looked at? The cock you will sometimes see on a church, and if you watch you will see him swing from side to side as the wind blows. Where his beak points is where the wind comes from. Under him are four arms pointing to north, south, east and west. You can see the letters, N, S, E, W at the end of the arms.



Sometimes there is only an arrow to point to the wind—but underneath will be the four arms to tell you which direction is N, S, E or W. A wind arrow is called a weather-vane.

When the wind blows from the north, what sort of weather do we have? Think of the old rhyme, "The north wind doth blow, and we shall have snow." It is

a cold wind, for it blows over cold lands. Get out your atlas and look to see where our north wind comes from. We are sometimes glad of it in the summer-time, for it brings a welcome coolness—but in the winter it is a bitter wind.

The east wind is another bleak winter wind. How grey and pinched everything looks when the wind blows from the east! The flowers huddle together, no buds open, the bees stay at home, we wrap up warmly, and put on gloves and scarves. The east wind brings no rain, for it comes to us over land, and has long since lost its moisture. It is a dry, bitter wind, and everyone is glad when it is gone. It often comes in March, and holds back the spring. In summer-time it is a hot wind, and seems to scorch everything up with its fiery breath.

The west wind brings us rain. Look at your map. Do you see what a long journey over the ocean the west wind has? It collects moisture on its wet journey, and gives it to us as it blows over our land. It is the west wind that piles up the big grey clouds and brings out our umbrellas.

The south wind is gentle, soft and warm. Even in winter-time it brings mild weather and sometimes rain. Look at your map. It comes from warmer climes than ours and gives us its heat, so that, even in the middle of December, we are warm if it blows, and do not need

HERE IS THE WIND AT WORK—BLOWING THE GRACEFUL YACHTS ALONG ON THE RIVER

to wear scarves and gloves or to keep up big fires. It gives us a taste of spring-time. It is a good wind, spring, summer, autumn or winter.

I wonder which wind blows the oftenest over our islands. Do you know? It is the westerly wind—the wind that blows from the west. Sometimes it swings a little to the south, and then it is south-westerly. It is a wet wind, and we generally have much rain all the year round because our "prevailing" wind, as we call it, is a rainy wind. We know why it is wet because we looked at our map to see where it came from, and we found that it came over the sea.

Other countries have other winds. There are

winds that bring parched heat, like the Sirocco of the Mediterranean countries. There are winds that bring icy-cold days and blinding snow, like the blizzard of the lands round the North Pole. There are strong rain-winds like the Monsoon of India, the regular, constant winds, like the Trade Winds, which were given that name because in the days of sailing-ships the traders used to rely on them to blow their ships along.

The wind works well for us. It cleans up the earth, dries the puddles, makes the air pure and sweet. It catches the big vanes of the windmills and sends them swinging round. The machinery of the mill is set going, and the farmer grinds his corn to make bread. In Holland the wind works very hard indeed for the people, and on a windy day the countryside looks very busy with all the windmills turning round and round ! The windmills work the pumps that raise water from the low-lying land.

We no longer depend on the wind to send our ships along, because we use steam or petrol now to send them over the sea—but the pretty yachts need the wind, and we also are glad of it when we take our toy ships down to the pond or the sea to sail them.

The wind helps the migrating birds, too. In the autumn, when they leave us for warmer countries, it is the north-east wind that helps them on their way. When they return to us in the spring the south-west

wind blows, and by its help they find their way back safely once again.

Trees and flowers also are helped by the wind. Have you seen the catkins that the hazel-tree hangs out so early in the year? They are full of pollen, and, when the wind blows, the catkins shake out their yellow powder, and some of it flies to the tiny red blossoms that sit on the hazel twigs waiting for it. Then, once the wind has brought the pollen to them from the catkins, they begin to make the nuts we like so much in the autumn. The grasses, too, that grow in the fields and in the hedges ask the wind to help them in their seed-making by blowing their pollen about through the air from one grass to another.

THIS IS A WIND-BAG AT AN AERODROME
Air-pilots can see at once from what direction the air is blowing

In the autumn all kinds of seeds depend on the wind to take them on their journeys. The sycamore keys use the wind, and the dandelion clocks are puffed away by the breeze. The thistle-down travels on the wind, and the ash keys fly off too. They could not do without the wind.

One of the chief reasons why the study of the wind is so important nowadays is because of the coming of air-travel. Airmen must know many things about the wind—how fast it blows, how soon it may be expected to change, whether the air-currents high up differ from those lower down, and so on. Then there are those curious things called air-pockets—" holes in the air "—airmen dislike those, and want to know all about them in order to prevent accidents. The more we know of the wind and its ways, the sooner we shall be able to travel with complete safety in the air.

THINGS TO DO

1. Watch a weather-cock or weather-vane each day, and see how the wind changes. If you are not sure which way the wind is really blowing, wet your finger and hold it up in the air. Which side feels coldest? That is the side from which the wind is blowing.
2. Write down five things by which you may tell there is wind about.
3. Write this down : " Our prevailing winds are westerly winds." Now write down why they are wet winds.
4. Draw a picture which will tell anyone looking at it that it is meant to show a windy day.
5. Ask someone to read you the story of Æolus and the Winds. It is an old Greek story, and you will find it in the Story of Odysseus, or Ulysses.

CHAPTER 4

HOW OUR BULBS ARE MADE

ARE the bulbs that you planted in your pots and bowls beginning to flower now? Have you some sturdy hyacinths glowing red or blue, or some golden daffodils shining on the window-sill? Perhaps it is still too early for those—maybe it is your snowdrops that are drooping their white heads, or the little scyllas making a patch as blue as the spring sky.

A great deal has happened since you tucked the crocus corms away in their bowl of pebbles and water, and hid the daffodil bulbs in the earth or the fibre. What have you noticed?

The bulbs sent white roots down into the fibre, to look for water to send up to the growing plant. They held it firmly, too. Then the shoot pushed up out of the bowl, and we said, "Oh, look! The hyacinth is growing!" The fat green shoot grew longer and longer, and one day we saw that there was a flower bud in the middle of it. The flower bud grew, too, and gradually colour came into it. Perhaps that is as far as your hyacinth has got—or perhaps it is in full flower, sending its strong, sweet scent over the classroom.

The crocuses growing in the pebbles were very

SNOWDROPS FLOWERING IN FEBRUARY SNOW

easy to watch. Some of the white shoots actually pushed aside the stones to make room for themselves as they grew ! Soon the white sheath round the shoot split, and we saw the thin, pointed green leaves. Then, growing between them, came the crocus flower itself, wrapped up in a white covering. Soon it, too, split its covering, and one sunny morning it opened wide—a yellow crocus beautiful to see. I hope you put the date of its flowering down on your Nature Charts !

How is it that the funny brown things we planted can grow and make such lovely flowers so early in the year ? What makes the snowdrop flower in the snows

of February? Why is the daffodil able to spring up so early and brave the bitter March winds? Do any of you know?

To find the right answer we must get a bulb of some sort and a crocus corm and see what is inside them. Then we shall know the secret of the early-flowering plants.

We do not need to pull up one of our daffodil bulbs or one of our hyacinths—we will get an ordinary onion instead. That is a bulb, too, and will do quite well.

Here it is. You have all seen onions at home—perhaps you have helped your mothers to cut them up for soup. They are the bulbs you know best of all.

Look at it. What is there on the outside? Thin, papery yellow-brown scales. Let us take them off and see what is underneath. Look! Here is the solid onion, full of good food for us—and full of good food for the plant, too!

We will cut the onion in half, from the bottom upwards, right through the middle. There! Look at the two halves. What can you see?

Examine the layers of white fleshy scale-leaves. We can separate them with our fingers. They fit one on top of another. In the middle is something else, cut neatly in half so that we can see how it is made.

It is the new onion plant. How carefully it is hidden away, leaves and flower-bud, neatly packed together.

1. ONION BULB CUT IN HALF. 2. CROCUS CORM CUT IN HALF. 3. CROCUS CORM SHOOTING (note where a new corm is being formed). 4. TWO NEW CORMS (note old corm below). 5. HOW A SHALLOW CORM GETS DEEPER DOWN (notice how the root has wrinkled by the corm, so pulling the corm downwards).

All bulbs—daffodil, hyacinth, tulip, snowdrop, scylla—are made in the same way as the onion. First come the outer papery scales—then come the layers of fleshy leaves, and last of all, tucked in the midst, is the new plant with its leaves, petals, stamens and pistil all ready prepared.

Right at the bottom of the bulb you will see a flattened, solid piece, and from this the roots spring that hold the bulb in the soil, and find water for the growing plant. Can you see it?

I am sure you know what the fleshy leaves are for. They are full of food, and they act as a well-filled larder to the growing leaves. The plant tucked away

inside needs plenty of food as it grows out of the bulb, up into the air, and this it takes from the juicy scale-leaves below. *We* enjoy an onion when we eat it, don't we? We feel there is a great deal of good stuff in it. You can guess, then, how the growing plant enjoys the stored-up food, and uses it to enable itself to grow tall and strong.

The plant sends up its leaves first, and then the flower. All the time it is eating up the stored food below. What will happen to those fat juicy white leaves in the bulb? Of course they will become thin and shrivelled, won't they? Their goodness is being taken from them and used by the growing plant. And there at last comes a time when there is no more food left at all, and the fat leaves are papery and dry.

But now the green plant-leaves are doing some work, and making food themselves. Some of it they use—but some of it they send down to their bases, which gradually become fat, juicy, and fleshy, just like the scale-leaves you saw in the onion we cut in half—and thus a new bulb is formed, ready to feed next year's baby plant, which is tucked away in the middle of the new food-leaves. The old food-leaves only remain as the papery, yellow-brown covering outside.

I expect you have noticed that we speak of daffodil or onion *bulbs*, but crocus *corms*. Doesn't the crocus have a bulb, then, like the daffodil? It certainly

looks much the same sort of thing outside, doesn't it? It is a squat little thing with a red-brown covering of paper skin. Why do we call it a corm, and not a bulb?

Perhaps it is different *inside*. Shall we look? We will cut it in half as we did the onion, and then we shall see what is inside. There! Look at the two halves of the corm. What do you see? Can you see juicy, thick food-leaves, as you did in the onion?

No, there is not a single one! All we can see is a solid white piece, and, at the top, a shoot, or perhaps two shoots, like smooth white teeth. If we have cut a shoot in half we shall find that inside are tiny leaves and a flower, just as there were in the bulb shoot—but the bulb shoot was inside the *middle* of the bulb, not at the top, as the crocus shoot is.

Do you remember seeing the flattened piece at the bottom of the onion—the piece from which the roots grow? Well, the crocus corm is entirely made up of that solid part, and has no fleshy food-leaves at all. It stores its food in the solid piece, and the growing plant takes it from there as it shoots up into the sunshine. As the food is used up, the white solid corm gets smaller and smaller. But it does not matter, because little new corms are being made at the top of it, where the new plant is growing.

A crocus may send up one, two, three or more shoots, all of which may flower. Each of these shoots

has leaves, which work hard in the sunshine and begin to store up food for next year. They store it in new little corms which grow at the foot of each shoot!

Shall we take up one of the crocuses we are growing in pebbles? Find one that has finished flowering if you can. See! Here it is. Look at this corm we planted—it has long, white, tangled roots growing from it now. Here is the long shoot that contained the leaves and flower that are now hanging limply down, finished. You can still see the white sheath that held the young plant.

Now look at the base of the shoot or shoots. If we are lucky we may be able to make out two or three new little corms forming there on top of the old one. If we plant this crocus in the ground the corms will grow bigger as the leaves still do their work, and we shall soon have two or three crocus corms where once there was one. How generous of the crocus to give us two or three corms instead of one! We shall have more flowers each year, as they multiply.

Will the crocus corms come nearer to the surface of the earth, year by year? The new corms grow continually on top of the old each spring season, and it seems as if they will at last reach the surface, doesn't it! Certainly the corms will eventually stick right out of the ground unless something happens to prevent them! The crocus has a good idea for keeping itself

[*Photo, Courtesy, Carter's Tested Seeds, Ltd.*

" DAFFODILS,
THAT COME BEFORE THE SWALLOW DARES, AND TAKE
THE WINDS OF MARCH WITH BEAUTY "

at the right depth. From one of the new corms grows a thick root, going right down below the little new corm. After a while the upper part of the root begins to get shorter and thicker—and the corm finds itself being pulled downwards as the root contracts—rather like a worm contracts when it is touched! For three or four years the same thing happens to each new corm, until at last the right depth is reached.

And now you can easily answer the question we asked at the beginning—How is it that daffodils, hyacinths and crocuses are able to flower so early in

the year? It is because there is plenty of food stored away for them inside the bulb or inside the corm. Frost cannot get at them because they are deep down in the earth, and so they are kept safe through the winter, and can push up their shoots early, feeding them well as they grow, out of their bulb or corm larders.

They flower early—but they die down early too, most of them! We must not cut off the long, yellowing leaves, because they may still have work to do in filling up the new bulbs or corms with food for the next year's plant. We must let the leaves die right down before we pull them off. We shall know when they are ready to come off because they will come away easily in our hands when we pull them.

Plant your old bulbs and corms—the ones that are flowering in your bowls now—in a corner of the garden when they are finished. Let the leaves stay on until they are done. Next year the bulbs will flower again, but not in bowls—only in the garden at the right time of year. They may perhaps miss a year before they flower—but sooner or later that corner of the garden will be gay for you in the very early spring!

THINGS TO DO

1. Look at an onion. Draw it.
2. Look at an onion cut in half. Draw it.
3. Look at a crocus corm cut in half. Draw it.
4. Write down how you would know a bulb and how you would know a corm.

CHAPTER 5

MAKING AN AQUARIUM

ONE of the most exciting things we can have is an aquarium. In this chapter I will tell you how to make one and get it ready for its many water-folk. It is perfectly easy and most interesting. Later on I will tell you how to stock your aquarium with various creatures and how to keep them healthy and strong.

To begin with, of course, we must get a glass tank of some sort. Did I hear someone mention a glass globe? No, I'm afraid that will not do. Pretty as those globes are they are not the right shape for fish or other water creatures, because they are curved in at the neck, and not enough water surface is exposed to the air. This is the reason why so many goldfish die in glass globes.

What we want is a straight-sided glass tank, say about twenty inches by fifteen, or bigger if we can get it. The height should be about a foot. We can get this cheaply from an electrician or from a wireless shop, if we ask for an old glass accumulator. Having bought our tank we must clean it thoroughly both outside and inside. Wipe it dry and stand it in the sun.

Now, set to work and find a collection of small

rounded pebbles. Hunt your gardens for them. Wash them thoroughly until they are clean and shining.

Now get some clean bird sand—or silver sand is pretty—from a shop. (Do *not* use sea-sand.)

Take your tank, and arrange all your pebbles neatly at the bottom. Cover them with your sand. Now can you find some much larger stones, which will shelter the water creatures and make your aquarium look like a real pond to them? If you can, find some stones with holes through the middle; they will like those. If you mean to keep tadpoles and let them grow into tiny frogs, arrange one of your stones so that it reaches the surface of the water. The little frogs will be glad of a resting-place at the surface.

Now we must fill the tank. For this you must get either pond-water or else rain-water from a butt. Do not use tap-water. Pond-water is full of tiny water-life, and is excellent for an aquarium. How are you going to pour it into your carefully arranged tank without disturbing your sand and pebbles? Well, you can either place a sheet of thick paper on the sand, and pour the water gently on to the paper, taking it up when the tank is about a third full and then filling in the ordinary way, or you can pour the water gently on to one of the big stones. Remember to pour slowly and gently.

Set your tank on one side until the water is per-

THIS SCHOOL AQUARIUM IS SIMPLY AN OLD ACCUMULATOR. IT MAKES AN EXCELLENT TANK
(notice the Canadian pondweed growing in it)

fectly clear. Whilst it is clearing you must go hunting for something else. This time you must visit ponds for water-weed. The most useful kind is that called Canadian pondweed, which you will find in trailing masses of green stalks, round which grow closely-set oval leaves. Duckweed you will know very well from its habit of covering a pond like green scum, floating thickly on the surface. You will find other water-weed, too, some floating loose, some growing up from the bottom of the pond, like the Canadian pondweed.

Why must we have water-weed in our aquarium? Do you know? I expect someone will say, "Oh, because it will be food for some of our creatures," and that is quite true. But the most important reason for putting water-weed in is that it keeps the water pure by aerating it. If we have water-weed in we shall rarely need to change the water.

How does the weed aerate the water? You will see, when you have put it into your aquarium. Once it has settled there and begun to grow, you must watch it on a sunny day. You will see a strange and lovely thing; from the leaves, or from a new-growing bud will shoot dozens of tiny, silvery air-bubbles, rising steadily upwards to the surface. Watch for them, won't you?

You must plant your pond-weed in this way: get three or four pieces and tie the ends of their stalks together with cotton. Now take a small stone and tie it to them. Drop the stone in the aquarium. It will sink to the bottom, dragging the weed with it. The weed will float upright in the water, and very soon will root itself in the aquarium and grow splendidly. Have as many little clumps as you like, and let one or two strands float loose to make your tank look green. If the weed grows too fast, thin it out.

Duckweed you may just drop into the water. It will grow on the top—but if you have this weed you

will not be able to look in at the top of your aquarium, because it will soon cover the whole surface. Still, it's fun to try anything. You can easily take out what you do not want.

Water-cress grows well in an aquarium, but is not so graceful as the other weeds.

Now, with sand and pebbles in, large stones for shelter, pond-water and pond-weed, our aquarium is finished—it is waiting for its water-creatures. It is not difficult to prepare, is it? You will have great fun starting it, and I expect you are all longing to begin. But once you have made your aquarium, there is still quite a lot to do. You must keep it CLEAN, or the water will smell and become cloudy.

I am sure someone will say that it will be quite easy to keep clean, because the water can be changed as often as necessary; but I don't want you to change the water! Perhaps once every three months you may like to change it, if it has become cloudy, and I will tell you the easiest way to do this without disturbing everything—but it should not need changing any more often than that. You can keep it clean yourselves quite well.

First, the water-weed will purify the water for you with its silver bubbles of oxygen. Second, you will please find a supply of water-snails, who will act as your aquarium dustmen, removing all rubbish and

eating all green slime! Isn't that a good idea? You will find water-snails in most ponds (land-snails will not do, of course). There are many kinds of water-snails, and any of them will be your dustmen. Put them gently into the aquarium.

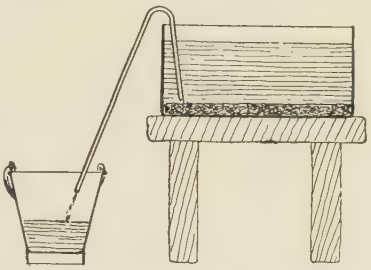
THE GREAT POND-SNAIL—A VERY USEFUL MEMBER OF THE AQUARIUM

They will feed on the pond-weed, and you will also see them rasping off the green slime that is sure to form on the sides of the tank, making it difficult to see into the water. You can watch them doing this. Their file-like tongue is rubbed up and down against the glass and, presto! it is clear and clean! You will never have slimy, blurred glass if you keep water-snails in the aquarium. They also feed on any decaying rubbish that you may have overlooked. After a time you will find that there are dozens of baby water-snails here and there, too, all helping to clear up!

Well, with the water-weed to purify the water and the snails to clean up the rubbish, is there anything left for *you* to do? Certainly there is. You must look into the tank each day and see if there is any bit of decaying food, any dead snail or other creature, and

get it carefully out. I always find that a pair of wooden pincers is best for this. Some people use a long iron spoon. Nothing should be disturbed when picking out any rubbish each day.

If you really *must* change the water, this is how to do it. It is really rather an exciting job, and you should know the way to do it. It is done by *siphoning* out the dirty water. Look at the picture and you will see how to do it.



HOW TO CHANGE THE WATER IN YOUR AQUARIUM, BY SIPHONING

First we want a piece of glass tubing, bent in two, so that there are two arms, one short and one long. The inside of the tube should measure about $\frac{3}{8}$ of an inch (we call that the *bore* of the tube). The short arm should be long enough almost to reach the sand at the bottom of the aquarium when the tube is hung on to the tank.

Before placing the glass tube in position you must fill it with water. You can easily do this by laying it down in a sink of water and letting it fill. Then place your finger firmly at the bottom end, and hang it on the tank, as shown in the picture. Take away your finger and the water will flow out into the basin or pail you have placed under the longer end to catch

the dirty water. Place a piece of gauze over the top end, or your tadpoles will flow away! Your tube will siphon out practically all the water for you, and you can then fill your tank with new pond-water or rain-butt water by using your siphon again (letting the new water run from a basin placed *above* the tank), or you may simply pour water gently on to one of the big stones from a jug.

Be sure that the fresh water is at the same temperature as the old. If it is not, your creatures may be chilled and die. Many goldfish have been killed in this way, by having fresh, very cold water put into their globe instead of water of the same heat as the old.

Put the aquarium in a cool, shady place, *not* on a window-sill nor in the sun. Direct sunshine should never be allowed to heat it. If it does, your animals will die. Many children put their jars of tadpoles in the sun, thinking they will like it—but this kills them when in a jar or tank. In a pond they can wriggle up to the sun, heat themselves, and then wriggle off to a cool place. They cannot do this in a jar, globe or tank. Some aquarium-keepers paste brown paper round the back and sides of the tank; I never do this, but instead I keep my aquarium in a shady corner, preferably near a north window. If you can put yours on a table near a north window it

should do well. If you have plenty of green weed a fairly strong light will not do much harm.

Put a pinch of salt in your aquarium occasionally. This helps to keep away disease.

If a hard, brown deposit forms down the corners of your tank clean it off with sand after emptying out the water.

Now I have told you all you need to know about starting your aquarium and keeping it clean. I will next tell you what to keep.

THINGS TO DO

1. Make your aquarium.
2. Search for pond-weed and pond-snails. Bring them home in a jar of water.
3. Keep your aquarium clean.
4. Watch for the air-bubbles gushing out from the pond-weed.
5. Stand by a pond and watch what you see in it—beetles, fish, snails, frogs, everything. Write down a list of them.
6. Draw an aquarium and put fish, water-weed and snails in it.
7. If you keep a goldfish in a globe find some pond-weed to put in the globe. It will like it very much. A few snails will also keep it company.

CHAPTER 6

STOCKING AND KEEPING THE AQUARIUM

I HOPE that you have all made an aquarium, because I am now going to tell you what to put in it in the way of livestock, and how to keep your creatures healthy and flourishing.

Have you put in your pond-weed and your water-snails? You may find the snails in most ponds. If not, they are cheap to buy, and you can easily purchase a dozen, or less, according to the size of your aquarium. A dozen will do in an ordinary tank.

I told you before that they will act as dustmen, eating refuse, and removing the green slime from the glass. They will also provide another interest—they will lay their eggs in little strips of jelly, on the side of the tank!

Watch the little dark pin-points in the jelly each day. You will see them growing bigger and bigger until at last you will be able to make out that each little amber pin-point is a tiny snail, complete with shell! Then comes a day when each minute snail walks out of the jelly, and proceeds to the pond-weed for a meal! They are beautiful little creatures. They grow rapidly, and soon become fair-sized snails. When

the jelly-slab is empty you can clear it away. If you get too many snails perhaps some boys or girls would like to have one or two themselves to watch in a glass jar at home—or if anyone has a goldfish at home it will be quite pleased to have one or two of the little snails for company—but remember to put weed into the water for the snails to feed on.

There are different sorts of snails. The ones I like best are the whelk-shaped Great Pond Snail, but the little Ram's Horn Snails are pretty, too. They are shaped like a ram's horn, as their name tells you. Most ponds have them.

You may put snails with any other aquarium creature, and they will neither do harm nor be harmed.

Most children will want to keep goldfish in their aquarium. They are such pretty creatures, and may be easily tamed. Under healthy conditions goldfish are very long-lived.

Now, first of all, when you go to buy your goldfish, you must be sure to get strong healthy ones. Do you know how to tell when a fish is well or not? Look at the top fin on its back. Is it well spread out, waving about as the fish swims? That fish is well, if so. But if the back fin is closed up, flattened down, something is wrong, and you must not buy that fish.

Then look at the fish and make sure that it has no little growths on it, because goldfish often suffer from

a fungus disease which shows itself in horrid cotton-woolly-like patches here and there. These patches are a fungus growing on the fish. When it reaches its gills it cannot breathe, and it dies. Choose a fish whose scales are clean and glistening.

Do not have more than two or three small fish in a little tank. You can put ants' eggs in for them, if you like (they are really the *cocoons* of ants, not their eggs), but there is very little food in these. You will find that one of the best things to feed your goldfish on is uncooked porridge oats. Nearly all of you children will have porridge for breakfast, I expect, so I am sure your mothers will sometimes let you have a pinch out of the porridge-oat packet for your fish. Do not give them more than a tiny pinch or you will find that it decays and spoils your aquarium. It will not hurt the fish to go without their oats at the week-end, so do not worry about that. They will enjoy tiny shreds of raw meat now and again, but please watch to see that no piece is left to decay in the water. Look each morning to see if there is any stale food to remove, or decaying leaf or dead creatures.

Do not give your fish bread to eat. Bread in an aquarium is not good.

Should one of your fish show signs of developing the fungus disease I spoke of, you must cure it. It is most infectious, so you must carefully remove the fish

from the aquarium, and put it by itself in a fair-sized jar of water. It is really better to catch the fish in a small net rather than to take it in your hands, for if it should jump out in fright it may injure itself.

Put it into a jar (and BE SURE THE WATER THERE IS AS WARM AS THAT IN YOUR TANK, or you may kill the fish), and into the water put some ordinary cake salt in the proportion of half a teaspoonful (a very generous half) to each quart of water. The fish will shake its head in dismay, for it will not like the salt water at all, but the salt kills the fungus. Each day change the water (same temperature each time, please) and put in fresh salt. You will see the fungus gradually disappear, and at the end of four or five days the fish is cured, its back fin is standing upright, and you may put the patient back into the aquarium again.

If the fish is very bad it may be longer before it is cured. Increase the salt, if so. Watch to see no other fish takes the disease. After you have taken out the ill fish you must change the water in your aquarium, in case the infection should be carried in the water to other fish. It is a good idea to put a pinch of Epsom salts into your aquarium now and again. A well-balanced aquarium (with snails and pond-weed) rarely gets unhealthy. Remember that any fish who looks weakly will benefit by a salt-water bath.

Of course, you must keep tadpoles in your aquarium! Go out to the ponds and get some frog-spawn. You will find some now. Bring it back and put it into the water. The black specks will develop into the tiny tadpoles. You may have a good many when they are very tiny—but when they get big you must take most of them back to the pond and let them go, for if you crowd your aquarium with them there will not be enough air in the water and your creatures will die. Watch them feeding on the pond-weed. And please remember not to keep scores in a little jar at home—four or five is quite enough if you want them to live!

When they grow their legs and lose their tails you must be sure to see that some of your stones are at the surface of the water for the little creatures to rest on and poke their noses out to breathe the air.

Twice a week you must tie a piece of raw meat to a string and hang it in the aquarium. The tadpoles will all come round in delight and nibble at it. Take it out before you go home.

Take a net and go to a pond. Scrape the net along the bottom and you may bring up some curious creatures called caddis-grubs, the grub of the caddis-fly. These little things have such soft bodies that to protect themselves they build hard cases of tiny sticks, pebbles, mud, shells, and so on. Put them in your tank and watch them crawling about.

If you want to perform a most interesting experiment, remove the hard case from the grub and put the grub in a glass jar with water-weed. Put into the jar some coloured glass beads—you will see the clever grub make itself a home out of the beads!

SOME OF THE CASES BUILT BY CADDIS-GRUBS TO PROTECT THEIR SOFT BODIES

You may like to have sticklebacks and minnows in your aquarium. You can catch them in a pond. You may put minnows with goldfish, but if you want sticklebacks keep them alone in the tank, with snails and caddis-grubs only, for they are given to fighting.

Perhaps you may catch a big black water-beetle, about two inches long! It feeds on pond-weed, and is a busy, interesting creature. Cover your aquarium when you have a Great Black Water-Beetle, or it will fly away. Many beetles can fly, you know! A piece of perforated zinc makes a good tank-cover.

THE MALE (*left*) AND FEMALE DYTISCUS WATER-BEETLE, NATURAL SIZE

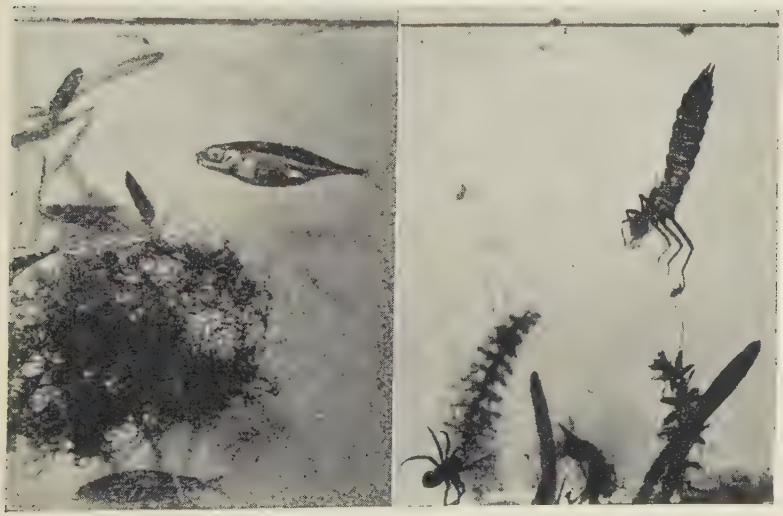
There is another water-beetle, about half the size of the one I have spoken of, called the Dytiscus Beetle. Do not put him in your tank with other creatures (except snails), for he will eat them. Feed him on raw meat.

You may perhaps find a dragon-fly grub in a pond and bring him back to your tank. Beware of him also, for he is a real dragon! He will gobble up tadpoles and attack fish. He is a great, big thing, two or three inches long, a little like an enormous misshapen earwig. If you could possibly keep him in a separate tank with snails and weed, and feed him on raw meat, you might have the glorious surprise of seeing him one day climb up a piece of weed to the surface, split his skin—and appear as a marvellous gleaming-winged dragon-fly! But it is very difficult to keep one properly.

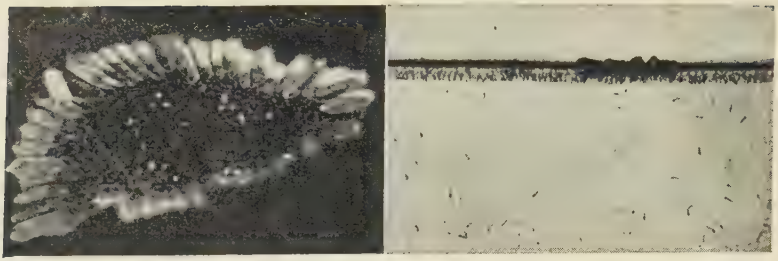
You may be able to take some newts from a pond. There are three kinds. The great crested newt is the biggest, a beautiful creature with an enormous crest all down his back. If you can keep one for two or three

days in your tank you must look at his finger-like feet, and see the wonderful colouring on his chest and under-parts. Goldfish are not very fond of newts, so do not keep them together for very long. Cover up your tank when keeping newts, or they will crawl out!

Look in rain-butts in the early summer and you will see tiny little rafts of eggs. These are the eggs of the biting gnat. Put some in your aquarium and watch them. The grubs come out from a little trap-door on the underside of each egg. You may also find gnat *grubs* in the rain-butt. (See p. 58.)



Left: THE STICKLEBACK AND HIS NEST. *Right:* A DRAGON-FLY GRUB STALKING A WATER-SPIDER



Left: A raft of gnat-eggs, seen from the top. *Right:* Gnat larvæ or grubs, just hatched from an egg-raft. Some are on the surface of the water, some are diving.

Left: Four-day-old grubs, taking in air with their tail-tubes. *Right:* Gnat larvæ change to pupæ when 11 days old. One is in the act of changing, and cast-off larvæ skins can be seen on the right.

Left: When 14 days old the gnat-fly splits open the pupa-case and climbs out. *Right:* After resting for a few minutes it is ready to stretch its wings and fly away.

The quaint little water spider really needs a small aquarium or jar to itself. It wants a fairly deep vessel, and this must be kept covered. Put in fresh pond-weed at intervals, and it will feed on the tiny water-life contained in it. Perhaps it will make its marvellous nest of air-bubbles for you to see. It will be happy without food or fresh pond-water for a few days if you wish to keep it only for a short time.

Here is a list of water-creatures that you may safely keep together :—

1. Water-Snails, Caddis-Grubs, Tadpoles.
2. Fish, Water-Snails, Newts.
3. Newts, Snails, Caddis-Grubs.
4. Dytiscus Beetle and Ram's Horn Snails.
5. Great Black Water-Beetle, Fishes, Snails, Caddis-Grubs.
6. Dragon-Fly Grubs, Trumpet-Snails, Caddis-Grubs.
7. Water-Spiders alone.

THINGS TO DO

1. Find a book about water-life. Read all you can about water-snails, newts, minnows, water-spiders and the rest.
2. Find pictures of any water-creatures and pin them on the wall.
3. Visit any aquarium there may happen to be near you.
4. Take a net and a jam-jar to the nearest pond and do a little fishing. Put back any creature you do not need.
5. Watch your fish each day to see that their back-fins are upright.
6. Write down all you see after you have paid a visit to a pond.

CHAPTER 7

TWO SINGERS—BLACKBIRD AND THRUSH

I THINK everyone knows the blackbird and the thrush—the blackbird because he is so black, and the thrush because of his pretty speckled breast. Surely everyone knows, too, how beautifully they sing, even if they do not know which song belongs to the thrush and which to the blackbird!

Has the blackbird visited your bird-table and pecked greedily at the porridge, potato or soaked bread? Has the thrush come, his bright eye on the look-out for his enemy the cat? What are they like?

The blackbird is a handsome bird in his dress of glossy black. What colour is his beak? What a bright orange it is! How it shines in the sun! Look at his bright eyes. Can you see his eyelids? They are orange-yellow, too, to match his beak. He is a smart-looking fellow, to be sure, and he is proud of his unusual plumage and of his perky tail.

He is always eager to show you what a fine tail he has. Have you seen him fly down to your bird-table or to the fence? Did you notice how he switched it proudly upwards as he alighted? Watch him next time, and see how anxious he is to show you his tail!

A great many people know the blackbird very well —but when they see his wife they are quite sure *she* is not a blackbird! Do you know why? It is because she is dark brown instead of black. She really looks rather like a large sooty-brown thrush. Perhaps you thought she *was* a specially dark thrush—look closely next time you see what you think is a large, dark-brown thrush, and you will find she is a hen blackbird.

Why do you suppose she is brown instead of black? Well, as she has to sit on the eggs, and make herself as little seen as possible, a sober brown is a much safer dress for her than the glossy black plumage of her husband. The cock blackbird rarely sits on the eggs. His wife hatches them out, and when she sits closely on her nest her dark brown dress is not easy to see. She wears it for protection. You will usually find that it is the cock bird of any species who wears gay feathers, while the hen bird is content with a dull dress. It is she who has to do the important work, so she is protected by her dull colours.

How can you tell the thrush? Yes, by his pretty speckled breast! His back is olive-brown, and his buff breast is freckled with fan-shaped spots of brown. His wife has the same colouring, but she is a little smaller. She does not need a different-coloured dress because there is nothing startling or striking about her husband's dress. She can safely wear the same!

The thrush is almost as big as the blackbird, and they both have the same habit of running quickly

THE GLOSSY BLACKBIRD

from one place to another on the grass, or of giving very long hops—especially the thrush, who can give surprisingly long hops.

I must just mention another thrush to you—the missel-thrush. I do not want you to muddle him up with the song-thrush. If you see what you think is a very large, pale thrush, it will be a missel-thrush, not a song-thrush. He is a rather ungainly bird, not so

neat and compact as the song-thrush. Perhaps you know him under the name of Storm-Cock. He owns that name because he loves to sing in a storm.

Both the blackbird and the thrush belong to the same family, and each sings beautifully. Some people cannot tell the difference between their songs, but there really is a great difference. I wonder how many of you could tell me which is which if you heard both?

First we will take the thrush's song. He sings beautifully. His notes are sweet and true, and he likes to sit in a tree at sundown and sing a good-night song. Listen to him. He finds a tune he likes and sings it over two or three times. "Pretty Dick, pretty Dick, pretty Dick! Ju-dy, Ju-dy, Ju-dy! Why did you do it? Why did you do it? Wit, wit, wit, you'll be late, you'll be late! Mind how you do it, mind how you do it, Ju-dy, Ju-dy, Ju-dy!"

So he goes on, finding one little phrase after another, enjoying himself thoroughly. It is delicious to listen to, and you can fit many funny little sentences or words to his song. The next time you hear a thrush singing, listen hard and see what he says to you. He may say: "Wake up, wake up, wake up!" Or, "I saw you, I saw you!" or even, perhaps, "How d'ye do!" There is one in my garden that says: "Dear dear, dear dear, dear dear!" regularly, and also "Bo-peep! Bo-peep!"

The blackbird sings more beautifully than the thrush, and he rarely repeats himself as the thrush does. He sings a melody that goes on to the end, a real tune. He sounds as if he is making it up as he goes along, thinking about it, enjoying it. But he often spoils it at the end by a funny explosive sort of noise, almost like an exasperated sneeze, if you can imagine such a thing! I do not know why he does it. It is a pity, because it does not suit his beautiful song at all. His voice is very loud, very clear, and sometimes as pure as a flute. Have you ever heard a flute? It has a beautiful liquid sound and the blackbird can imitate it well.

Do you think you will be able to tell which bird is singing now, if you hear him in the morning or the evening? Remember—the thrush likes to repeat his little tunes—but the blackbird goes on and on with his melody, sometimes ending with that funny, hissing sort of noise I have told you about. Be sure to listen well, and you will soon be delighted to find that you can tell at once which bird is singing to you, the blackbird or the thrush.

Both blackbird and thrush have loud call-notes, as well as songs. When they are alarmed they make a most tremendous noise, really startling, the blackbird especially. I know that sometimes in the quiet evening, when I have been reading in the garden just before

[*Eric Hosking.*

A MOTHER-THRUSH WITH HER NESTLINGS

sunset, I have been so startled by a blackbird's loud alarm-rattle that I have dropped my book and leapt to my feet in astonishment.

Perhaps it was just because the blackbird had spied one of my cats somewhere, and immediately it raised the alarm. "Chacka-chacka-chacka-chacka-chacka!" it screamed and rattled, and at once all the other birds, many of whom had gone to roost, awoke in fear

and cried out too. They know that the blackbird is fond of a joke and will sometimes scream just for fun —but when he is serious they pay heed to their sentinel, and a hundred frightened black eyes watch the garden closely to see whether a cat, an owl or a sparrow-hawk is near. When you hear a loud alarming rattle of a call, look to see if it is made by a blackbird. You will probably spy him on the fence, switching his bold black tail up and down.

The thrush sings nearly all the year round, but the blackbird generally sings only from February to July. He is at his best in the spring evenings. Listen for him now. The birds are beginning to sing bravely in the early mornings, and if you are awake you will probably hear both the thrush and the blackbird practising their songs in your garden.

Did you know that birds sometimes sing "under their breath" as you do? You often hum or even whisper a tune, don't you? So do birds! I have heard a thrush singing under his breath, all to himself, as he sat in a bush in the rain.

The thrush and the blackbird like to eat worms, grubs, insects, berries and fruit. They love the juicy fruit in the autumn. When the apples and pears fall from my trees the birds fly down to them—and when I go out to gather up my windfalls I find that some of them are nothing but skin and core, for the blackbirds

and thrushes have pecked out every bit of the sweet fruit for themselves! I have seen a greedy blackbird eat a whole pear in a morning! Sometimes they peck the apples on the trees until nothing is left hanging but the skin. I am quite willing for them to have their share of my fruit in return for the beautiful songs they sing me, but I sometimes wish they would leave me a few cherries! They take nearly every one of those!

The thrush is very fond of snails of all kinds. He picks them up in his beak and goes off to his "anvil." This is a big stone, or perhaps a rock, and he bangs the poor snail down on the stone with all his might. Crack! Its shell splits and the thrush gobbles up the soft flesh inside. I have a big flint in my garden that is used by two or three thrushes because it is near a rockery where the snails hide. On a spring morning I hear, "Click, crack, click, crack!" all the time as the thrush takes one snail after another to be cracked on his "anvil." The path around is strewn with scores of empty shells.

Most boys know the difference between a blackbird's nest and a thrush's. Who can tell which is which? One is lined with mud, and the other has a neat layer of grass over the mud. The thrush lines his with mud, but the blackbird prefers his lining to be softer, so he puts grass on his mud. You must often

A THRUSH AT HIS "ANVIL" WITH A SNAIL IN HIS BEAK

have seen, in the months when the trees are bare, a large nest, firmly tucked into a bush, with a bowl-like lining of hard mud that has withstood all the winter weather. Some thrush nested there last year.

The blackbird builds usually in trees or bushes, but the thrush builds almost anywhere—not only in trees and bushes, but in sheds, walls, banks or on the ground. Both birds use small twigs, grass, leaves, moss, hair or wool, and make a solid, comfortable nest. The only difference is that the blackbird adds a soft lining to the mud to make the nest more cosy.

The thrush's eggs are very blue, with black spots.

The blackbird's are green-white freckled with reddish-brown. Do not take them if you happen to find a nest. Do not even touch them, for fear the bird turns the touched egg out of the nest when it returns. Show a nest you have found only to those you can trust. It is best to keep it a secret just to yourself.

Watch for the youngsters when they hatch and are taken into your garden to be fed. See how they stand with open orange beaks for the bit of worm or grub their mother is finding for them. Listen to the loud piping sound they make! We will hope that the cat does not catch them, because we want our gardens to be full of music next spring-time, when all these baby songsters have grown into thrushes and blackbirds.

THINGS TO DO

1. Listen for the thrush to sing. Put some words to his song and tell them to your teacher. Remember that the thrush sings each tune two or three times over.
2. Listen for the blackbird's song. He sings a melody and does not repeat himself. Listen for the explosive sound at the end.
3. Draw a blackbird. Put him an orange beak and orange-rimmed eyes. Draw his wife and colour her dark brown.
4. Draw a thrush sitting on her nest. Write these words underneath :—

   " That's the wise thrush; he sings each song twice over.
   Lest you should think he never could recapture
   The first, fine, careless rapture."

   (The poet Browning wrote these words.)
5. Watch a thrush on the grass. See how he puts his head on one side. Do you think he is watching for a worm, or listening?

CHAPTER 8

YOUR GARDEN (I)

I WANT you this summer to have a lovely, flowery garden, a place where bees and butterflies come, a place of delicious scents and gay colours. You will have to work hard at it, but I know you will love it.

Have you a garden already? Perhaps you have. Has it been a great success? I hope so—but if not perhaps it will be this year!

I am going to suppose that you have not had a garden before, and so you do not know much about it—and I shall tell you exactly what to do to make it a success the very first year.

Your patch of garden must be in a nice sunny corner. Let it face south if possible. Do not have it under trees, or near to overhanging buildings, or the drips from overhead will spoil your plants. It should have been well dug in the autumn, but if it was not, dig it over now.

Pull up all the weeds, of course. Make your patch clean, level and smooth. Can you edge it with something to make it neat? I often use big stones or flints, but if I do I examine them once or twice a week to see that slugs are not using them for a hiding-place.

Now we have to do a most exciting thing—we must choose our seeds! I always love doing that, and so will you. One of you must go to the various seedsmen in your town and ask if you may have their seed-catalogue. Or you may write to some of the seedsmen and ask for their catalogue. You want to know prices and you want to know what the flowers are like that you mean to grow.

Here are some flowers to look for in your catalogues. They will grow in either country or town. Virginian stock, candytuft, African marigolds, nasturtiums, clarkia, mignonette, shirley poppies, cornflowers, lavatera (mallow), Californian poppies (eschscholtzia), and sunflowers. Look them up and read about them. You are fairly sure to be successful with those. You can try other kinds next year.

Write out your list of seeds. Then you can go and buy them at the seed shop, taking your list with you. You will probably see that the seedsman has a whole stand of coloured seed-packets. Have a look at them. Don't they look exciting? Whenever you have the chance of looking through them, do so, because the pictures on the packets will make you familiar with the flowers. Buy GOOD seeds, not cheap ones.

Seeds are among the prettiest things in Nature. They are so small, so numerous, and many of them are so prettily marked. Look at the quaint brush-

ESCHSCHOLTZIA MIGNONETTE

like seeds of the cornflower, and the pretty flat yellow seeds of the candytuft. Look at the big sunflower seeds with their markings. All the seeds are different, and you must have a good look at each kind before you plant them.

Before you sow your seeds go to your garden bed and make sure it is quite ready. You may have to crumble up the soil a little, because seeds like fine earth to grow in. The tiny roots they put out cannot deal with big lumps! It is best to plant seeds after a rain-shower, but if you water well beforehand it will do instead.

[*Photo, Courtesy, Carter's Tested Seeds, Ltd.*

CORNFLOWERS CANDYTUFT

Run a stick along the soil to make what is called a shallow drill—a little furrow for the seeds. Now drop them carefully in. The big seeds you can plant one at a time—the nasturtiums, for instance, and the sunflowers. Do not plant them too closely; read the directions on the packet carefully to see the right distance apart.

Little seeds you can shake out of the packet straight away—but only a boy or girl with a steady hand must do this, or with one jerk half the seeds will land in one tiny patch, and that will not do at all! You will find that the best writers in your class will be the best

persons for planting your seeds, because they are used to keeping their hands straight and steady. Do not plant the little seeds thickly, or you will have a mass of tiny plants, growing closely together, all gasping for air, and none of them will do well. Plant thinly always, except in the case of virginian stock, when you want a good thick edging.

When you have put in your seeds you must cover them with a light layer of soft soil. I usually take up a few big pieces of earth and crumble them lightly in my hands over the seeds. Then you must get a little wooden label and write on it the name of the seeds you have planted and stick it into the ground near them.

You will, of course, be sure to plan your bed carefully so that you get the tall plants at the back and the tiny ones in front. I will give you some little garden plans in the next chapter. In two or three weeks' time, if you have planted your seeds in April (which is the best time), you will see a host of tiny green things peeping above the ground. Each day they will grow bigger and bigger, and you must be sure to keep the bed well weeded, so that no other plant steals the light and air from your seedlings.

Water your plants if they need it, but do not flood them! Draw up a list of those responsible for watering each day, and see that a boy or girl waters before

CAN YOU MAKE YOUR SCHOOL-GARDEN LOOK LIKE THIS? I AM SURE YOU WOULD BE PROUD IF YOU COULD!

school in the morning. That is the best time, before the sun gets too hot.

Keep a garden-chart, and put down on it what seeds you chose, when you planted them, when they grew, when they flowered and so on. Draw the different leaves and flowers.

You will feel very pleased when you can actually cut a bunch of flowers to put in your schoolroom, or to take to someone who is old or ill.

When your seedlings grow you may find that they are very numerous and far too close together. You must thin them out, if so. It is better to have a dozen beautiful strong plants than to have fifty miserable little things. Stake any that need it, before the wind blows them down.

If you want your plants to go on flowering for a long time, watch for the seed pods or heads to form and nip them off as soon as they do. Once seeds have formed, the plant considers that its duty is done, and it is willing to die—but if you cut the pods off continually, the plant goes on producing more and more flowers, trying to form seeds, and your garden is kept gay for months.

Next year you will want to grow seeds again, and you might as well try growing some of your own. Towards the end of the summer term notice which of your plants are the strongest and the finest. Let them form seeds, and then, when ripe, cut off the seeding heads and shake the seeds into an envelope. On the envelope write the name of the flower and stick on a picture of it, which you can cut from a seed catalogue.

Put down on your garden-chart the different bees

and butterflies that visit your flowers. Watch for any kind of blight, and syringe the plants with soapy water if they show signs of it. What a number of things there are to do in even a little garden, are there not?

In the autumn, when you return to school, you must clear up your garden ready for next year. Pull up all the old plants, pull up the weeds that have grown in the holidays, and make a heap of them. Then have a bonfire. You will enjoy that! Then dig over the ground well, and leave it for the frost to break into fine powder. Your year's garden work is done!

THINGS TO DO

1. Prepare your patch of ground.
2. Get seed catalogues.
3. Write down a list of flowers you think you would like to grow. Put down their heights, their colour and time of flowering.
4. Go and look at the seed-packets in the seedsman's shop.
5. Buy your seeds. Buy GOOD seeds, for poor seeds will not repay you for your trouble.
6. Plant your seeds carefully and label them.
7. Take care of them. Weed. Water. Keep a garden-chart.

CHAPTER 9

YOUR GARDEN (II)

IN the last lesson I told you how to start a garden, what flowers to grow, and how to care for them and make them a success. Now I want to give you a few more hints, and I want to make sure, too, that even if you cannot have a garden, you will have either a window-box or a row of pots on your window-sill! There is no such word as "impossible" where flowers are concerned!

Town schools may have to make do with a window-box instead of a garden. Many schools may like to have this *as well* as a garden, for there is nothing that makes a house or school prettier than rows of flowers on the window-sills! You will have the passers-by standing and staring in delight if only you make a success of it!

First you want a long, rather deep wooden box. Measure your window-sill and find out the size. Have you any boys who are good at carpentering? Perhaps they would be clever enough to make the box for you. Or maybe one of you is lucky enough to have a father who is a carpenter, or handy with his tools, and if you ask him he might make the box for you. Do not be defeated by any difficulty, will you? It makes things

even more exciting and worth while if you can get them only with difficulty.

Now we will suppose you have your stout box. Ask your teacher to let you stick the poker into the heart of the fire. Get it red-hot. And now your teacher will have the excitement of boring holes through the bottom of the box with the red-hot poker! You will have to do this in the playground because there will be a lot of smoke. These holes are for drainage, so that when you water your plants in the box the surplus water may run freely away through the holes instead of standing at the bottom of the box and causing your plants to rot.

Now the holes are made. The next thing to do is to cover the bottom with bits of broken flower-pots, or you may find your earth flowing out of the box with the water! Perhaps a nearby florist or nurseryman will let you have some if you explain what you want the bits for.

Now scatter cinders or small pebbles over the pot fragments, and fill your box with as good earth as you can get. You are ready to fix it on your window-sill and plant your seeds now! It was easy to make, wasn't it, and most interesting? Candytuft, virginian stock and nasturtiums are quite good plants for a window-box. In the autumn you can pull up your old plants, dig over the soil well, and plant crocuses and daffodils. They love a window-box.

Do not water too much at once. A little each morning before school is best, when the weather is dry. The bees and butterflies will visit your flowers, even if you are in the middle of a big town. Choose your sunniest window.

You may grow many plants in pots for your window-ledges. Choose fair-sized pots so that the roots of your plants may have plenty of room. Scrub the pots well and make them clean. Put them in the sun to dry. Now fill them with good earth, putting pieces of broken flower-pot or small pebbles at the bottom first. Leave two or three inches space at the top to allow for watering. Plant your seeds by scattering a few on the top. Lightly cover with fine earth. Water the soil before you plant. Stand the pot in a saucer so that surplus water may run out, but do not let the pot remain standing in water—always empty the saucer and replace the pot in it.

When the seeds come up, make up your mind how many plants you want in your pot. It is *always* best to have a few rather than many, for then you will get beautiful, strong plants with fine big flowers. Too many plants will give you small, weakly flowers. You may have virginian stock fairly thick in a pot, but if you choose mignonette, have only two plants, and pull one out carefully, when you are sure that the other is going to do well.

THIS SPLENDID ARRAY OF SCHOOL GARDEN-PLOTS IS IN THE MIDST OF A GREAT TOWN. THE CHILDREN ARE AT WORK IN THEIR VEGETABLE GARDENS, BUSILY WEEDING AND WATERING THEM

You may have two or three plants of candytuft if you like, in one pot, but if one is an especially fine plant, pull out the others and leave just the one.

You can grow nasturtiums in pots very well. Nip off the seeds as they form and then the plant will go on flowering. Clarkia may also be grown in pots. You may have three or four plants in one pot.

Do not forget that you can grow the seeds of wild flowers in pots, too. A pot of sturdy, golden-yellow buttercups is a lovely sight !

If you are really interested in growing flowers—and I have never yet met a boy or girl who was not—you will like to know that there are three kinds to grow.

There are Annuals—those that I have told you to grow from seed, such as the candytuft and Shirley poppies. Annuals come up, flower, and die all in the same year.

Then there are Biennials. These are flowers that are planted one year, and flower the next. For instance, I sow seeds of the biennial plants Canterbury bell and Sweet William in the summer of this year. They sprout and grow into sturdy little plants by the autumn. They are strong enough to withstand the winter. I put them into their right places in my beds before the winter frosts begin, and there they stand sturdily all the cold weather through. They grow well the next spring and flower brilliantly next summer. Then they die. They have lived through two seasons, and we call them *Bi*ennials because of that.

[Many words that begin with Bi mean Two, as you know—think of Bi-cycle, Bi-ped, Bi-valve.]

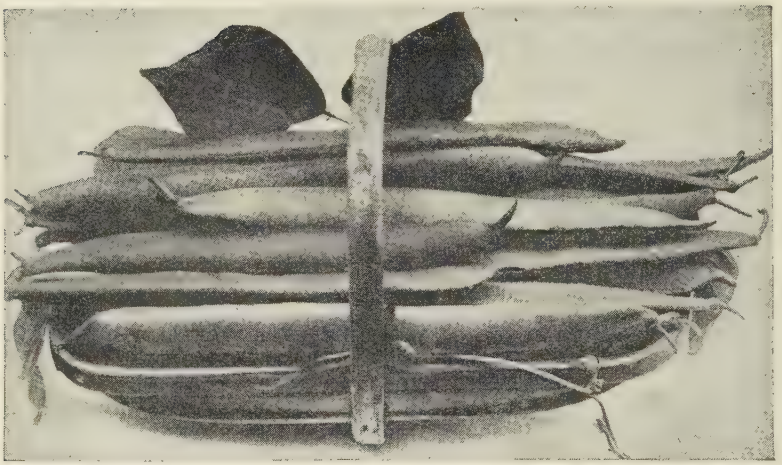
Perennials are plants that live for year after year, such as Michaelmas daisies, the big oriental poppies, Marguerite daisies and so on. They are very useful to have in a garden because they will look after themselves, and grow of their own accord each spring.

Perennials are usually grown in a new garden by

means of little clumps taken from plants of friends. In the autumn many people dig up their perennials and break them into two or three pieces. They throw away the old parts and re-plant the strong new pieces. Sometimes they have clumps to give away, and they would be glad to give them to you. Have you any parks near you? If you have, make friends with the keepers and find out all you can about the park flowers. In the autumn, when they divide up the big clumps that grow in the park beds, they will be pleased to give you some of the best ones that are over, and you can plant them in your school garden. Always try to make friends with anyone who has the care of flowers, trees or animals, for they will be able to tell you a host of interesting things, and you will never be dull in their company.

Plant annuals in your garden for a show of flowers this year. Perhaps you can also get a few pansies, or violas, one or two plants of forget-me-not, and a double-daisy or two to make the garden pretty now. Plant the seeds of biennials if you want such things as snap-dragons, Sweet Williams and Canterbury bells *next* year. Plant perennials, such as Michaelmas daisies, if you want plants that flower *each* year.

In some gardens there is space for a few vegetables, too. It is such fun to grow our own mustard and cress, our own radishes and lettuces!

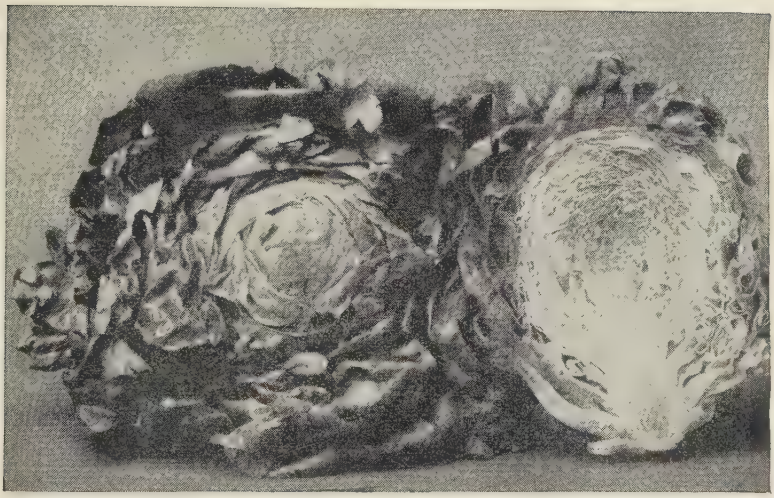


[*Photo, Courtesy, Carter's Tested Seeds, Ltd.*

BEANS GATHERED FROM THE SCHOOL GARDEN

You can try growing five different things. At the back of your plot plant some scarlet runner beans. Do not plant the beans too closely—not less than a foot apart. They will climb up the sticks you put for them in no time, and put out their lovely scarlet flowers very quickly. You will have a fine crop of beans from them, and you might sell them to buy your seeds for next year. When the climbing stem reaches right to the top of the sticks (the sticks should be at least 6 ft. high), you must ask somebody tall to pinch off the top of the shoot for you. It must not grow any higher.

In front of the beans plant lettuces. The seed is so tiny that you had better mix it with sand when you



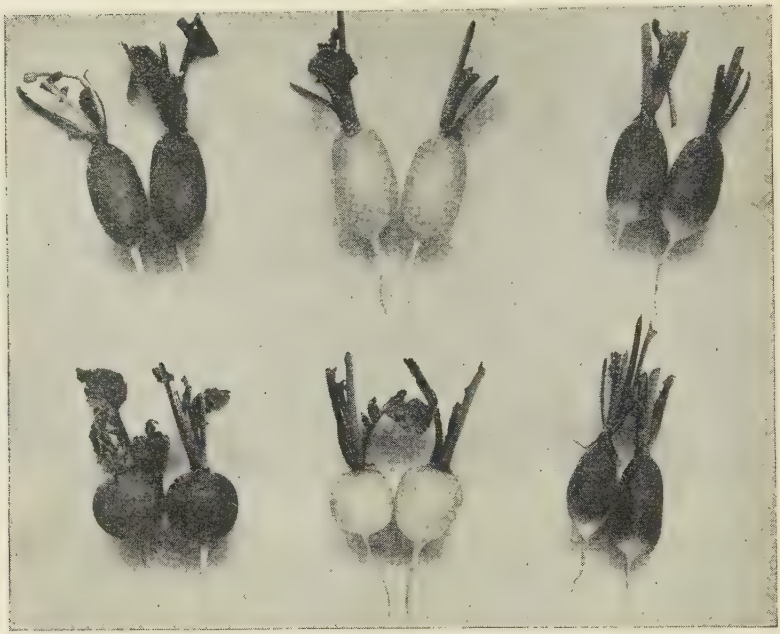
[*Photo, Courtesy, Carter's Tested Seeds, Ltd.*

A CABBAGE LETTUCE WHOLE AND ONE CUT IN HALF. YOU CAN GROW DOZENS OF THESE IF YOU HAVE ROOM

sow it, or you will sow too thickly. Thin out the little plants when they grow, because you want good strong lettuces. Cabbage lettuces make pretty green rosettes as they grow, so you could choose those.

Grow mustard and cress in front of the lettuces. Sow thickly. *Remember to sow the cress four days before you sow the mustard,* because it takes longer to grow and you want to eat them at the same time. You can sow it in the form of the initials of your name if you like, or in the shape of an M for mustard and a C for cress. It will come up in green letters then !

Right at the front you can grow radishes. Thin



[*Photo, Courtesy, Carter's Tested Seeds, Ltd.*

SIX DIFFERENT KINDS OF RADISHES WHICH YOU CAN GROW IN YOUR SCHOOL GARDEN

them out if they grow too thickly. Let each radish have enough room for itself. You will like to see the pinky-red roots growing rounder and rounder, peeping just above the soil. Water well in dry weather.

The fifth thing you can grow is mint. You must start this by a root. You can get one for a penny or twopence, but perhaps one of your fathers will give you a piece from his garden. Once it begins to spread (it is

a perennial and grows each year of its own accord) you can train it all round your little garden. When new potatoes come in there may be enough for you each to take a sprig home.

When your radishes, lettuces or mustard and cress are ready to eat, it is fun to take a loaf of bread to school one afternoon, and some butter, and have a garden picnic. Things that you have grown yourself have the nicest taste in the world! Wash them well, put them on dishes, cut your bread and butter, and enjoy the things you have grown so carefully.

Here are just a few little plans for your school plots. You can make some up yourself by reading your seed catalogues carefully and finding out the heights of the different plants.

1.	2.	3.
Back.	*Back.*	*Back.*
Cornflowers.	Lavatera (Mallow).	Canary Creeper.
Shirley Poppies.	Cornflowers.	Clarkia.
Candytuft.	Clarkia.	Candytuft.
Virginian Stock.	Nasturtium.	Californian Poppies (yellow).

4.	5.	6.
Back.	*Back.*	*Back.*
Climbing Nasturtiums.	Sunflowers.	Cornflowers.
Cornflowers.	Cornflowers.	Candytuft.
Mignonette.	African Marigolds.	Mignonette.
Virginian Stock.	Dwarf Nasturtium.	Californian Poppies.

Note.—Do not use sunflowers if your plot is very small.

CHAPTER 10

THE STRANGE CUCKOO

WHEN the springtime comes, we look for the first swallow, we hunt for violets on the banks, we gather the dancing wind-flowers—and we listen eagerly for the first cuckoo! It is a lovely sound to hear, that first "Cuckoo! Cuckoo!"

But although we love to hear the cuckoo calling and give him a great welcome, he does not really deserve it. He is a strange bird, with strange habits, a bird "gone wrong." He cannot help his habits now, poor thing, for he is born with them—but at some time, far away in the past, there was a time when he could choose between goodness and badness, and alas! he chose the wrong path. And now all our cuckoos are forced to follow the same downward path. Let me tell you about them.

First of all, do you know what the cuckoo is like? You may have heard his voice a hundred times, and yet have never once seen him! You may not know whether he is big or small, light or dark.

He is about as big as a jackdaw, and he is light in colouring. He is slate-grey above (the colour of slate tiles), and he has a pale grey upper breast. The rest

of his under parts are white crossed with dark bars, rather like a hawk. Indeed, little birds often think he is a hawk and mob him angrily, especially when they find him near their nests, for hawks, as you know, catch and eat small birds.

The cuckoo arrives in April. We hear his cuckooing as soon as he is here. The hen cuckoo does not cuckoo. Very often the male bird cuckoos loudly when he flies. That is about the only time you are sure of seeing him.

The hen cuckoo never builds a nest, and neither does the male.

THE CUCKOO IN FLIGHT. IT IS A BIG BIRD, AND IS BARRED UNDERNEATH RATHER LIKE A HAWK

When the time comes for the cuckoo to lay an egg she hunts about for a nest like that in which she was born. If she was born in a pied wagtail's nest, she finds one belonging to a pair of wagtails. If she was born in a meadow-pipit's nest, she hunts for one of those. She stands near the nest and makes a sort of mewing noise. In the nest there

may be three or four new-laid eggs. The cuckoo flies to the nest, sits on it and lays her own egg there among the others; sometimes she lays her egg on the ground and then carries it to the chosen nest. When it is in the nest she picks up one of the other eggs and flies off with it. I expect she thinks that "Fair exchange is no robbery," don't you? She eats the other egg, and then, as she will probably lay a second egg within 48 hours, she looks for another nest to put the next egg in. She lays four or five eggs on alternate days, each in different nests. Then she has a rest from egg-laying, but after a while she lays a second lot, once more in different nests.

You know how big a wagtail is, don't you, or the little meadow-pipit? Not nearly so big as the cuckoo! Therefore you would expect the cuckoo to lay much larger eggs than the small wagtail or meadow-pipit, just as a goose lays far bigger eggs than a small duck. But the strange thing is that the cuckoo, in spite of her large size, lays eggs about the same size as those of the bird into whose nest she puts her eggs. And another curious thing is that her eggs are very much the same in colouring as the other birds' eggs. The only exception is when she lays her eggs in the hedge-sparrow's nest. As I daresay you know, the little hedge-sparrow lays eggs of the purest brightest blue. The cuckoo *can* lay blue eggs, but very often she puts into the hedge-sparrow's nest an egg that is grey-brown and spotted,

and it does not match the blue ones at all. It so happens that the hedge-sparrow is one of the few birds that does not seem to notice whether her eggs match or not—so the cuckoo's egg is left unharmed!

The foster-parents, as we call the birds in whose nest the cuckoo's egg is placed, take no notice of the exchanged egg. You might think that as the egg is laid there *after* the foster-parents' eggs had been laid, the cuckoo egg would hatch out *later* than those—but it does not! It hatches out either before or about the same time, so that the young cuckoo shall not have very big birds to deal with when he is hatched himself.

What a strange baby he is when he cracks his egg and crawls out! He is quite black and quite bare of feathers or down—an ugly little imp, with curious feet. They have two toes in front and two toes behind—the feet of a climbing bird, like a parrot, not of a perching bird. Think of a sparrow's feet—three toes in front, one behind. Why has the cuckoo the feet of a climbing bird, when in after life he is going to be an ordinary perching bird?

You will soon see. As soon as the baby cuckoo is hatched he knows whether or not there is anything else in the nest with him. If there is, he gets into a furious rage and resolves to throw out whatever is there. There may be two or three eggs, there may even be tiny

birds, not long hatched. It does not matter how many there are, he is determined to get rid of them all.

In between his shoulders at the beginning of his life is a small hollow. Somehow or other the little cuckoo, quite blind and just newly hatched, gets into this hollow one of the eggs he can feel beside him.

Then he starts to climb up the side of the nest with his two-toed feet. Now you see why he is born with the feet of a climbing bird! It is because he needs to climb when he is very, very young—not because of any climbing when he is grown-up! The side of the nest seems very high to him, but somehow he climbs up it, backwards, so that he may tip the egg he carries overboard. He feels with his tiny wings to find out when he is at the top of the nest. When he is he jerks the egg out and it falls to the ground and smashes.

He tumbles to the bottom of the nest, exhausted. But if any more eggs are there he starts off once again, and he does not rest until he is alone in the nest, King of the Castle! If there were young birds there instead of eggs it would make no difference, for he would hoist them on to his back and climb slowly up the side of the nest to throw them out. They struggle and try to cling to his back so that they may not fall—but what is there to cling to? Not a feather, not a piece of fluff or down!

Do the parents of these poor little birds rescue them?

[*Eric Hosking.*

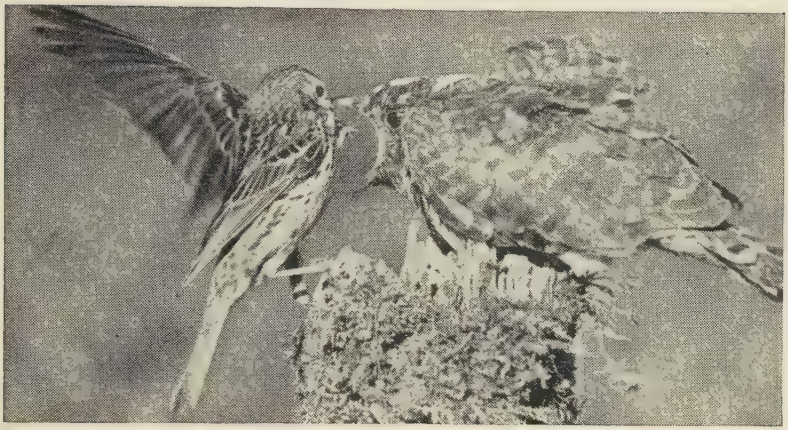
A YOUNG CUCKOO THROWING A BABY HEDGE-SPARROW FROM ITS NEST

No, they take no notice of them at all. That is strange, isn't it? Although they must have seen the baby cuckoo doing these horrid deeds, they do not seem to mind. At any rate, they make no effort to stop him, nor do they try to get their own youngsters back into the nest. Instead, they seem proud of the cuckoo, and do their utmost to feed him well. Perhaps they think he is an extra fine child!

The cuckoo keeps them busy. How hungry he is! How he grows! How he calls! He is always ravenous, always screeching for more food, always growing bigger until the nest really will not hold him! Other birds hear his piercing cries and come to feed him, too!

Soon he is far bigger than his little foster-parents. They stand on his great shoulder to feed him. He takes all they bring him, and is especially eager to eat the furry caterpillars they find. He loves those. Cuckoos are the only birds that really feast on these, and they do not seem to mind the hairs on the caterpillars at all. His foster-parents work all day long to keep him satisfied—far harder than if they had had three or four youngsters of their own kind to feed! One cuckoo eats more than half a dozen hedge-sparrow or wagtail babies! He does not heed the warnings of his foster-parents to be quiet when danger is near. He just goes on yelling, "Chiz, chiz, chiz!"

Then at last he has to leave the nest. He follows his parents about, always calling loudly and piercingly. I once had a young cuckoo in my garden, fed and looked after by a pair of wagtails—and I always knew when he was about! *What* a noise he made! I really felt quite cross with him, and I knew how the other birds must feel who heard him—"Oh!" they thought, "for goodness' sake, feed the child and keep him quiet!"



[*Eric Hosking.*

A MEADOW-PIPIT FEEDING A YOUNG CUCKOO

And a robin, a hedge-sparrow and another wagtail all came to feed him, as well as the two wagtails.

In May you will hear the cuckoo calling all day long. In June he calls a little differently. In July the grown-up cuckoos begin to leave us. In August they are all gone. What a little time they stay with us! The young cuckoos do not leave with them. They stay until September. Then the meadow-pipits (titlarks), who look after the baby cuckoos more often than any other kind of bird in England, leave us, and the young cuckoos leave too. They seldom cuckoo before they leave, but the next year when they return they will cuckoo loudly, if they are males.

I wonder what made the cuckoo start out on its

strange path, what formed its bad habits and its lazy ways. Was it because it was marked like a hawk and had its nest destroyed by little birds who feared hawks, and so was forced to lay its eggs in other birds' nests, having none of its own? Was it because the baby cuckoos, with their piercing voices, made other birds feed them besides their parents, so that gradually the parent cuckoos left even their eggs to be looked after by the other birds? Or was it because the cuckoos built such bad, clumsy nests that at last they gave up building altogether and used their neighbours' nests? What do you think?

There are many sorts of cuckoos in the world. Some do build nests of their own—bad, untidy ones, it is true. Some share one nest between them, and eggs, young birds and older birds lie in it together! Others do as our own cuckoos do—lay eggs in another's nest and so deceive other birds. An untidy, makeshift family, the cuckoos!

And yet we are always glad to hear their pretty double-note in the spring!

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Dear Boys and Girls,

I wish you could come with me and walk over the hills, through the fields, and down by the river, finding a hundred exciting or beautiful things by the way. I should like to take you fishing in the ponds, and fill your jars with snails and tadpoles. I should like to help you to make a fine bird-table, or to prepare a splendid aquarium. I should like to give you a garden of your own, and show you how to make it a place of bright colours and sweet scents.

But I cannot do all these things—so instead I have written these four books for you, so that you may read them and do for yourselves all the things I would like to do with you. We will go round the year together, and you must discover with your teacher and your friends all the exciting things there are to be found in Nature study.

Good luck to you in all your Nature work, and may you find as much delight in using these books as I found when writing them for you!

Enid Blyton

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CHAPTER 1

THE TALE OF THE TADPOLE

I AM sure that most of you will be able to read the Tale of the Tadpole in your aquarium tank. Probably you have quite big tadpoles by now and know a good deal of the life-history of the funny little creatures.

Who knows why the frog puts her eggs into jelly? It seems rather a queer thing to do, doesn't it? What a lot of eggs a frog lays! You have seen the spawn floating at the top of the water in great masses, I expect.

Have you picked up—or tried to pick up—any frog-spawn in your hands? It is so difficult! It slips out of your fingers and flops back into the water. It is too slippery to hold—and too slippery for any hungry creature in the water to eat! A tiny hatching tadpole would be a tasty mouthful for, say, a fierce water-beetle—so the jelly is put round the egg to guard it. Ducks are about the only things that can eat frog-spawn—and even then it sometimes slips out of their beaks and they have to try again! It is no good looking for little water-creatures in a pond where ducks live, for the ducks eat everything they find!

The jelly always floats to the surface, so that the sun can shine down on it and hatch the eggs. At first the little black eggs in the middle of each blob of jelly are quite round—then they get longer, like tiny sausages, or fat commas—and then at last the jelly begins to fall to pieces and the little black specks float out. They are the tiniest of tadpoles, just able to wriggle about. They hold on to the jelly at first, and then, when they are stronger, they float to the nearest water-weed.

How queer they look, these wriggling tadpoles! They have a long head and body ending in a tail. We cannot see any eyes or mouth. They cling to the water-weed by means of little suckers under their heads. I expect you have seen them doing that in your aquarium.

In a short time we can see yet another change in their shape. The head becomes distinct from the body, a proper little mouth forms, and something grows out of the tadpole's sides—four feathery-looking things. What are they? They are gills to help the tadpole breathe whilst it is in the water. Have you seen them?

Our tadpoles soon learn to swim about all over the place, and we can watch them feeding on the water-weed in our aquarium. They grow bigger and fatter. The feathery-looking gills disappear! They gradually

THE LIFE-STORY OF THE FROG, FROM EGGS TO FULL-GROWN FROG

shrivel up, because better gills grow inside their bodies, and they do not need the outside ones any more. Perhaps you have seen all this happen already, and your tadpoles are now big healthy-looking creatures, round and fat. You really cannot tell where the head ends and the body begins!

They are not quite so black now. Look for their bright eyes. Can you see them? They need other food than the water-weed—they like the little water-fleas and other tiny creatures almost too small for us to see, but which live in crowds in pond-water. That is one reason why you must put pond-water in your aquarium, and not tap-water. The tap-water has no water life in it, but the pond-water has plenty. If you will put a cupful of fresh pond-water into your tank once a week you will find that your tadpoles like it very much and flourish well. The tank-water evaporates, so you must keep up the water level.

Tadpoles also like a bit of raw meat occasionally. Tie a piece to a string and hang it over the side of the tank for a day or two each week. You will see the tadpoles come and nibble at it with great enjoyment. Take it out before you go home after school. If any bit of it falls off, do not leave it to decay in the water. Spoon it out.

Tadpoles will be frogs when they grow up, so they must grow legs. Watch your tadpoles. One day you

will see that one or two have tiny back legs growing. Ah, now they really begin to look more frog-like, do they not?

One of the differences between frog and toad tadpoles is that the *front* legs of the toad are noticed first. The front legs of the frog-tadpoles are growing too, but they are hidden at first behind the gill-cases, and we do not notice them.

What funny little legs they are! Have they toes? How many? Does the tadpole use his new legs to help him swim, or does he still use only his big tail? Watch and see.

"Oh," you will say one day, "his tail seems to be much shorter!" So it is. It is disappearing! The tadpole's body is using it up, drawing out the goodness in it, making it become smaller and smaller—until at last there really isn't any left! And when that happens we cannot call the tadpole a tadpole any longer; he is a tiny frog. He could sit on a sixpenny bit easily, he is so small. He has four little legs with toes on the end, and his body is ridged on the back like a grown frog's.

The tiny frog does not like to keep in the water all the time—he keeps bobbing up to the surface and sticking his blunt nose out. He does not breathe with gills now, but with lungs, like us—he is an air-breathing creature, not a water-breathing one. What a number

of changes he has had in his short life! He is soon going to become a land-creature now, so he practises breathing the air at the top of the pond. Or, if he is in your aquarium, he clambers up the stones you have put there, and sits on the one you have allowed to peep out of the water. He is very comfortable there, and he will sit and blink at you (for he has grown eyelids now, too!) and enjoy himself.

You cannot very well feed small frogs, for they need flies and other insects, so the time has come for you to say good-bye to him and put him back in the pond, with all the other small frogs that have grown up there since the spring-time. What a large world the pond seems to him after his sheltered aquarium! How full of dangers! I expect for the first few days our little frog has a great many frights.

If it is hot, dry weather the small frogs remain in the pond or in the muddy places near it. They are waiting for a good rainstorm before starting out on an exciting journey to find a home for themselves. One day the rain pours down and soaks everything. Good! That is the signal for the little frogs to leave the pond and go to the ditches and meadows.

Each little frog finds a nice damp spot for itself. Some hide under leaves. Some crawl under stones. Some squat at the bottom of ditches. And there they stay till they are hungry and the night is cool and

dark. Out they come and hunt for slugs or any other tasty creature. They are fond of flies, too, and these they catch in the daytime, when any unwary insect comes near their hiding-place. How do they catch flies? Have you ever seen a frog or toad catching one?

A TOAD IS A GOOD FRIEND IN OUR GARDEN, FOR HE EATS SLUGS AND MANY OTHER INSECT PESTS

Both frogs and toads have a queer tongue. It is fastened at the *front* of their mouths instead of at the back like ours, and so they can flick it in and out a long way. It is sticky at the tip, and when the frog sees a fly perching near by he flicks out his ready tongue, the fly sticks to the tip, the frog draws in his tongue—and swallows the fly! It is all done so quickly that it seems like magic.

Do you know the difference between a frog and a toad? The frog is smoother-skinned, and he has a startling habit of suddenly jumping high into the air. This is useful to him when an enemy sees him. The toad has a rough, warty skin, and he crawls, instead of jumping. On his back he has a great many little bags holding a stinging liquid, and if an enemy tries

to bite him the toad squeezes out his poison, which tastes so nasty that his enemy leaves him in disgust. The toad lays eggs in long *strings* of jelly, not in masses, like the frog.

In the autumn the frogs and toads find damp places to sleep in. The frog likes the bottom of a pond. The toad likes a hiding-place under a big stone. There they stay all the cold winter through, hearing and seeing nothing. In the warm spring-time they wake up—and once more the ponds become full of frog-spawn, and the Tale of the Tadpole begins all over again! Our little one-year-old frogs do not lay eggs—they are not grown-up yet, and will not be full-grown frogs until they are three or four years old—but the old frogs lay their eggs, and once again we see hundreds of little tadpoles wriggling gaily.

THINGS TO DO

1. Look at your tadpoles carefully. Draw one. When you notice any difference, draw one again. Put dates each time.
2. Tell the Tale of the Tadpole shortly, from the spawn to the frog.
3. What is the difference between a toad and a frog? Do you know one from the other? If you do not, try to find out this summer.
4. Tame a toad if you can. He likes to be tickled on his back with a straw.
5. Look at the eyes of a toad. They are unexpectedly lovely.

CHAPTER 2

HOW NEW FLOWERS ARE MADE

IN this chapter I am going to tell you how it is that flowers are able to make seeds which in their turn grow into flowers themselves.

First of all, look at a flower carefully. I do not know what flower you have before you, but it is sure to have all the things I am going to talk about. Look underneath the flower. What do you see there? Do you see some green leaf-like things? Do you remember that when the flower was in bud these green sepals, as we call them, folded over the flower and protected it from cold and rain? Have you a bud there? Look at it and see if the sepals are doing as I say.

What comes above the green sepals? Yes, you all know—the petals.

Now look inside the flower—what are those yellow-headed things standing round the middle of the flower? They are stamens, and most of you know that they hold pollen. Do you remember shaking the yellow pollen-powder out of the hazel catkins? It came out in a cloud. Touch the stamen heads with your finger. If they are ripe you will find that the tip of your finger

is yellow. On page 21 is a picture of pollen grains showing what they look like under a microscope.

Now look right into the middle of the flower. You will see a green thing—the pistil. What is it like? Do you see its green tip? Touch it. Does it feel sticky? Has it a neck running down to the bigger part we call the seed-box? The tip is the *stigma*, the neck is the *style*, and the seed-box the *ovary*.

You might think that the most important parts of a flower were the protecting sepals, or the bright, showy petals, and that they could well do without the inner parts. But it is just the other way about—the stamens and the pistil are the most important parts, and sometimes a plant does without its sepals or petals —think of the flowers of grass, which are only stamens and pistil, and have no petals or sepals at all. But a plant cannot do without its stamens or pistil, for if it did it could never make seed.

That is why the stamens and the pistil are so important to the plant—they make seed; and without seeds to grow new plants what would happen? We should have a very bare world, shouldn't we!

Now I will tell you how a seed is made. You know that the head of the stamen (the anther) holds pollen powder. This is in the form of very tiny grains, all of which want to go to a pistil of a flower—if possible a pistil of *another* flower, not their own flower. How

A HONEY-BEE GATHERING POLLEN FROM A FLOWER. ITS VISIT WILL HELP THE FLOWER TO MAKE SEEDS

can the pollen go where it wants to? It cannot fly off by itself, so it must get something to help it. Perhaps, if the flower blossoms early in the spring, before insects are about, it will ask the wind to help its stamens. If it flowers now, when many bees, butterflies and other insects are everywhere, it will ask some of *those* to carry its pollen from one place to another. Somehow or other the flower will see that its pollen is carried away to where it wants to go.

We will suppose that a bee carries away the pollen. It comes looking for honey in the flower, and rubs

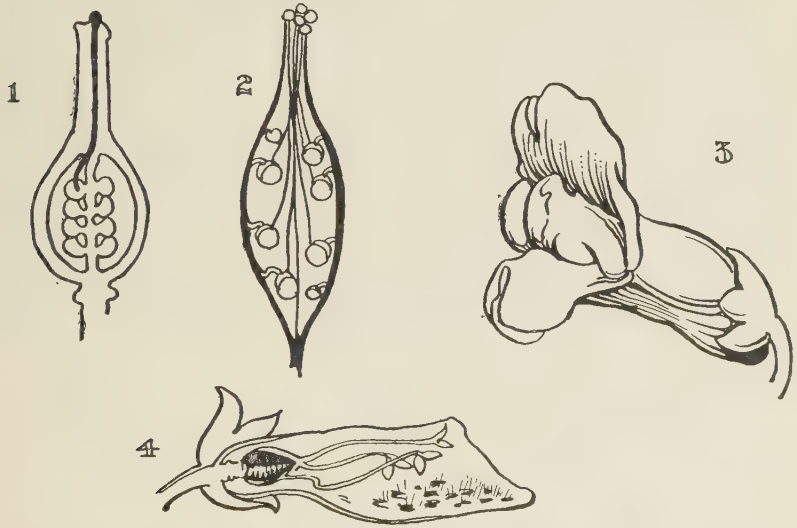
against the ripe stamens. They spill their pollen-grains on to the bee's back (have you seen a bee dusted with yellow pollen?), and when the bee flies off to another flower, taking the pollen on its back, those grains will be rubbed against the green pistil there, and will cling to it, because both grains and pistil-tip are sticky!

Now what happens? Something very strange indeed, something you could not see or guess yourself. Look at the picture opposite. No. 1 is a picture of the inside of a pistil. Do you see the fat part at the bottom and the long neck above, ending in the pistil-tip? At the tip is a pollen-grain. A bee brought it to the pistil from another flower a few days ago.

The pollen-grain knew that it had come to the right place. It began to put out a little white tube, and this made its way all down the neck of the pistil. Can you see it? It went right to the lower part where the ovules waited. Do you see the ovules? They look like seeds, and they *will* be seeds later on when each one has been reached by a pollen-tube. They are not seeds yet. They are only little half-seeds. They never will be seeds unless they are reached by a pollen-tube, because the pollen brings them what they need to become a whole seed.

The pollen-tube in the picture has travelled down to an ovule, and it has grown into it, right into the very middle. There was a little hole in the ovule's

two coats left ready for the pollen-tube to enter, and it easily found its way. Now it is joined to the ovule, and the little half-seed will soon be whole. It has got



THE PARTS OF A FLOWER

1. The inside of a pistil showing how the pollen-tube travels to an ovule.
2. Many pollen-grains putting out tubes to ovules. The two tiny ovules have no pollen-tubes and so have not grown.
3. A snapdragon flower. The bee alights on the lower part and its weight opens the "bunny-mouth."
4. The inside of a foxglove. Do you see the barricade of hairs at the entrance?

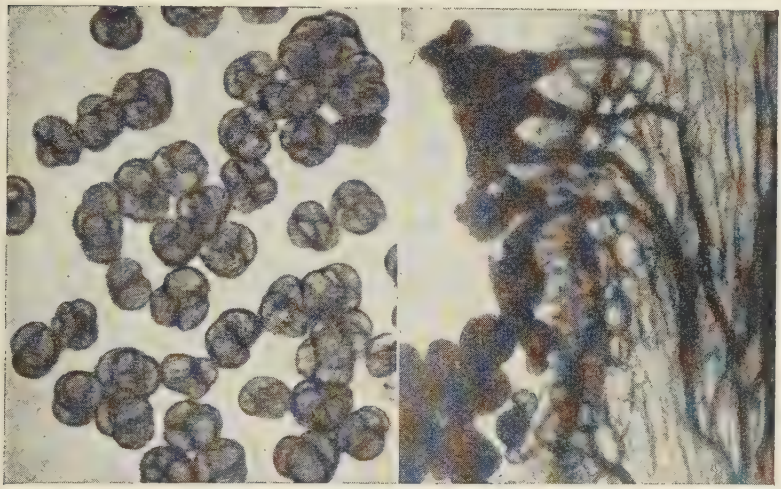
what it wanted, and now it can grow marvellously, can develop into a healthy seed, and in time go on a journey to find a new home, where it may grow into a vigorous new plant all by itself.

All the little half-seeds in the ovary may be reached by pollen-tubes, and all may grow into whole seeds. The ovary is soon so full that it has to grow too! It swells and becomes larger. When the seeds are ripe it dries up and bursts, and the seeds are freed.

You have all shelled peas, I expect. But how many of you have seen the flowers that came before those long pods? How many have seen the young pea-pods, so small, so thin? You all know *sweet*-pea flowers, don't you? Well, pea-flowers are the same shape but smaller. When the petals fell off, the pistil was left—a tiny pod. It grew and grew, and the seeds inside became fat and round. Before they were ripe their pod was picked, and perhaps *you* shelled the peas inside. Did you notice that at one end there were very small peas—perhaps one or two—that had never grown? They did not become pea-seeds—they remained little ovules, little half-seeds. Why? Who knows? Yes—because no pollen-tube reached them! Therefore they could not undergo the magic changes that made them into big fat seeds. They had to remain small and useless.

The pollen-grain and the ovule are partners. A pollen-grain by itself, or an ovule by itself, can never make a seed.

It is better for a plant to have pollen from *another* flower's stamens for its seed-making, than from its own stamens. If a plant uses its own stamens' pollen



Left: WHAT POLLEN-POWDER LOOKS LIKE UNDER A MICROSCOPE. *Right:* A WONDERFUL PICTURE OF POLLEN-GRAINS SENDING THEIR TUBES DOWN THE STIGMA OF A FLOWER TO THE OVULES

for its pistil the seeds will not be so healthy or so hardy as they would be if pollen from another plant were used. That is where the bees, butterflies and other insects come in—they take pollen from one flower to another, and so make sure that the seeds are the best that can be got! They do not know they are doing this, of course! No, they go to seek the honey that the flower provides to tempt them, or even to eat some of the pollen itself.

An insect crawls into the flower for honey and becomes covered with pollen. Then it crawls into the next flower and the sticky pistil there takes some of

the pollen from the insect's back. All sorts of insects help the flowers. Those with open cups are visited by many kinds. Those with closed cups or with long honey-tubes (think of the snapdragon with its closed cup, or the nasturtium with its long honey-tube) attract more intelligent insects, such as the bee or the butterfly, which have long tongues to probe down the nasturtium spur, and in the case of the bee are wise enough to be able to open the closed " bunny-mouth " of the snapdragon to get at the honey inside.

Indeed, some of the bees are cleverer than they should be, and instead of opening the " bunny-mouth " of the snapdragon and crawling down inside the flower, past the stamens and pistil to reach the honey, they bite a hole at the bottom of the flower where the honey is kept, and so reach it by a short cut ! When they do this it means that they do not brush against the pollen or the pistil, and so seeds are not made by that flower—unless it can use some of its own pollen, which it does not really want to do.

When the plant is going to use the wind to blow pollen on to its pistil, it does not bother about lovely petals, sweet scent or delicious honey. It produces simple flowers, plain and not easily seen.

But it is a different matter when living insects have to be used. Then flowers must have colour, brightness, scent or nectar—and the more particular

they are about the kind of insect they want for visitor, the more complicated the flower becomes! Think of a simple wild-rose flower, with its open cup spread wide for any visiting insect. Then think of a snapdragon with its complicated "bunny-mouth," or a white dead-nettle flower, a sweet-pea flower, or the long throat of a foxglove made specially for the big humble-bee. The foxglove has even grown a barricade of hairs at its entrance to stop tiny insects from crawling in! It prefers humble-bees, and means to get them. It does get them too, as you will soon find out if you watch a foxglove plant.

Now you know exactly how a seed is made. Use your eyes as you go about, and see how many different shapes of stamens and pistils you can find. You will be quite surprised at the discoveries you make!

THINGS TO DO

1. Draw an open pea-pod from memory. Put in it some fat, ripening seeds, and one or two ovules that have never grown. Write down underneath why these ovules have not become seeds.
2. Look at the stamens and pistils of as many flowers as you can this summer. Draw some of them on your Nature-chart.
3. Try to find out whether plants grow in any other way than from seeds. (Bulbs, corms, runners, etc.)
4. Watch snapdragons, foxgloves, and nasturtiums this summer to see the bees in them. Watch a butterfly closely. Try to see it uncoiling its long tongue to put into the heart of a flower. Look at the first picture in this book.
5. Look at the green flowers of the stinging-nettle. Would you think that the wind or insects took the pollen from stamens to pistil?

CHAPTER 3

THE SUN AND ITS WORK

WE have learnt about the work of the wind in another book. Now we will see what work the sun does, and we shall be surprised to find how very important it is—so important that none of us would be alive if the sun were not shining !

It is difficult to look at the sun, isn't it ? We can see it better in the early morning and evening. It is not so bright then ; it is like a round red ball. As it rises high in the sky it loses its redness and becomes the bright golden sun we cannot look at for long.

What is the sun ? Even if I tell you, you will not be able to imagine what it really is, because it is so strange, so mighty, so magnificent. It is big—far bigger than our big earth, a million times bigger. It is a great ball of fire, a fire so hot that even rocks would melt at its touch. It is very far away from us —ninety-three million miles away. We cannot any of us imagine such a distance—but we can think how very, very hot the sun must be to warm us even when it is so far away !

The sun is so fiery that rocks, and metals such as iron, would not even remain in it as liquids—they

would be heated until they were turned into gases. *We* can melt iron in our big furnaces so that it runs like water. Rocks are melted in the heat of volcanoes and run down the mountain-sides—but the metals and rocks in the sun are just gases. If they were allowed to cool they would become first liquid metals and rocks, and then the solid metals and rocks we know. But however much I tell you of the heat of that enormous ball, the sun, you will never be able to realise it—why, even the "flames" around the sun are thousands of miles long!

It is no wonder that, with such an enormous fire in the sky, we are well warmed and well lighted! The sun is our lamp and our fire, and it is our clock as well. We set our clocks and watches by the sun.

Each morning he appears over the eastern horizon, climbs the sky in an arch, and sinks again in the western sky, over the edge of the world. We know that the sun does not *really* climb the sky, don't we?—it is really our world that is turning round from west to east, making it seem as if the sun is travelling from east to west! When we are enjoying the sunshine other children are sleeping in darkness on the other side of our round world. When they get up and go to school in the sunlight we are going to bed in the twilight. How strange it seems!

The sun warms the earth with its rays, and in the

summer time sometimes warms it so much that we are far too hot! In very hot countries the people dare not go out in the noonday sun. They lie and rest. Is the sun hotter in the morning or at noon in our country? At noon, of course, when its rays fall straight down instead of slanting! In the morning and in the evening the sun's rays are long and yellow, and the shadows are very, very long. At noon the rays are dazzling bright and shadows are short. Have you ever tried the Shadow Game?

You go out into the playground and make a mark. Stand on the mark and get someone to draw carefully all round your shadow with a piece of chalk. Now go two hours later and stand on the same mark. Get your shadow drawn again. It will be smaller and in a different place! Try two hours later still, and your shadow will be very short and small. Then two hours more, and you will find that it has grown, until when evening comes it is as long as it was in the morning—but opposite where it was drawn then! It is fun to try this game. It will show you very clearly how the sun alters shadows.

We often say to one another, "Oh, the sun is shining now. We can go out to play." Wasn't it shining before then? Yes, it was—but we could not see it. It was behind the clouds that had crept across it. We could not see it or feel its warmth. It was as

A DAY OF GLORIOUS SUNSHINE AT A KENTISH FARM

if someone had put a fire-screen in front of the fire, blocking out its heat and light. But, all the same, the fire was there, as we could see if we peeped round the screen.

And if we could peep round the clouds we should see the sun there, shining brightly in the sky. If we had an aeroplane we could fly through the blanketing clouds, and on the other side we should come into dazzling sunshine. If we looked back on the clouds we should feel dazzled too—for the whiteness of them would reflect back the brightness of the sun, just as snow reflects it.

Have you seen the sun go behind a cloud in the evening time? Did you notice the gold edge to the cloud? That is made by the sunshine on the other side of the cloud. Have you seen the silver edge of a big cloud that passes across the sun in the daytime? That is made in the same way. You have all heard of the "silver lining," haven't you? Look out for a gold-edged cloud and put down on your Nature chart when you see one.

A great deal of the sun's warmth and light is reflected back from the earth and lost in space. It is the heat that is taken in by the earth that warms us so much—for when the earth is thoroughly warm it heats the air about it, and that makes us feel deliciously warm. A man in a balloon may feel very cold, although he is floating in full sunshine—for the sunshine around him does not warm the air—it simply passes through it. But we, down on the ground, may feel terribly hot, because the sun has warmed the earth, which in its turn is warming the air we breathe and move in—and although we are only receiving just the same sunshine as the man in the balloon, we feel ten times hotter!

The ground acts as a sort of radiator for us. Most of you have radiators in your schools, haven't you, or you have perhaps seen them in church. They warm the air around them, and so make *us* warm. And

THE SUN SINKS IN THE WESTERN SKY, LIGHTING UP THE HIGHEST CLOUDS AS IT GOES

that is what the hot ground does for us too—like our school radiators, it warms our air, and we say, "Oh, what a hot day!"

If there are clouds in the sky, the warmth of the earth cannot get away, for the clouds act as a kind of blanket and keep the warmth in. But if the sky is clear, especially in the evening, the warmth radiates rapidly away, and we say, "How chilly the evening is!" It is not only because the sun is gone that we are chilly, but also because our great big radiator, the ground, is sending its heat up into the clear sky and losing its warmth rapidly.

Did you know that the sun gave us our moonlight as well as our sunlight?

The moon has no light of its own. It is a world like ours, of hard rock and metals—but it has no living thing on it, so far as we know. It is not a great big fire, as the sun is. What happens is that the sun shines on it and lights up the moon so very brightly that when the moon reflects the sunlight it seems to shine with a light of its own! Moonlight is simply reflected sunlight! Isn't that strange? If there were no sunlight there would be no moonlight.

Indeed, when the sun does not shine on the side of the moon turned towards us, we do not see the moon at night. The next night we see a little bit of the moon, a tiny curve—then a bigger curve, then half the moon, then three-quarters and then the full moon—in fact, just as much of the "face" of the moon as the sun is shining on. When the moon is full, how bright it is! How it lights up the earth! What a strange, cold light it gives, so unlike the sun's warm, dazzling radiance. And yet it is a light borrowed from the sun itself and reflected back to us.

When the sun shines on *us*, our earth looks to the moon just as the moon looks to the earth, only much, much bigger. Isn't it curious to think that we shine on the moon and light up its dark places at night with "earth-light"!

The sun does a great deal of work for us. It is not only a lamp and a fire to us, but it helps to bring the rain. It draws up the moisture from the ponds and rivers, seas and puddles, and makes them into clouds. Then from the clouds comes the rain that freshens the flowers and makes the seeds grow.

The sun gives colour to everything. Think of a day when thick clouds hang over us—how dull and grey everything looks; but as soon as the sun comes out, see how the flowers light up, the green leaves shine and the fruit reddens.

The sun dries up the roads for us, melts the ice on the wintry ponds, penetrates into damp ditches and meadows, and makes them dry for the summer-time. It does smaller things for us, too—it dries the clothes on the line (with the wind's help), and it makes the damp grass dry enough for us to picnic on. What else does the sun do? Yes, it helps the farmer in his hay-making, and it ripens the fruit on our trees; it is our good friend in a hundred and one ways.

THINGS TO DO

1. Play the Shadow Game you have just heard about.
2. Draw something the sun does, and write underneath what the sun is doing in your picture.
3. Write down what is meant by the "silver lining."

CHAPTER 4

THE SWALLOWS AND THE SWIFT

ALL of you are sure to have seen the swallows and the swifts this year, darting through the air on their swift wings, their forked tails plainly showing. They come back to us in April, ready to nest in their home-country where they were born, and we are glad to see them, because we know that when they arrive summer cannot be very far away!

We have three different kinds of swallows—did you know? There are the barn swallows, the house martins and the sand martins, all of which belong to the swallow family. Do you know one from the other? I have not forgotten the swift—but as he does not belong to the swallow family I will leave him until later.

I should like each one of you to know the barn swallow by sight. Will you try to recognise him? Have you a coloured picture that will help you? This is what he is like—he has a bright, steel-blue back, a chestnut forehead and throat, a blue bar across his chest, buff under-parts, and a very long forked tail. He flies swiftly through the air on his long, pointed wings, and his song is a sweet, musical twitter—feetafeetit, feetafeet, feetafeetit!

Perhaps most of you know the barn swallow quite well. But can you tell the house martin swallow when you see it? Nine people out of ten will tell you that the house martin is the barn swallow, but you must be the tenth, and say, "That is a *house martin!*"

This is how you can tell the house martin from the swallow—his tail is shorter, the lower part of his back is white, and he has no chestnut on his throat. If you watch him as he flies you will soon see the white patch on his back. Look at it in the picture on page 35. Do you see his shorter tail?

You are not so likely to know the little sand martin, for he prefers the quarries, the railway embankments and the sand-pits to our houses or sheds, and so we do not see him around us so much as the other two swallows. He is the smallest of them and has no blue back, so you can easily pick him out from the others. His colour is mouse-brown with white under-parts, and he has a brown band across his chest. His tail is not much forked and is much shorter than the swallow's. I wonder if you will be able to pick him out from the other swallows when you see him. You will have to read these descriptions two or three times before you can picture them in your head—and if only you have a large coloured picture of all these birds to see, whilst the descriptions are read, you will soon be able to know by sight all the swallows we have!

Now I must tell you about the swift. Do you know him? Look at the picture. What long, sickle-shaped wings he has! Look at his tail. Is it as forked as the barn swallow's? No, but it is certainly sharply forked. In colour he is sooty-black all over, except for a small white patch under the chin, difficult to see when the bird is any distance away.

If you see a swift in flight you are sure to say what a good name he has—for he certainly *is* swift! He tears through the air at express speed, and he often screams and screeches as he goes, making a noise quite unlike the pretty twittering of the swallows. He may sometimes startle you in the evening, for then he loves to race round the street corners on his long wings, uttering screams of joy and excitement!

It is strange that he is so like the swallows, isn't it? and yet belongs to quite a different family. But, you see, he lives the same aerial life as they do, and so he has grown like them. Birds that live on insects which they catch whilst on the wing need long, pointed wings for speed, a streamer-like tail, and a small beak with a wide gape for catching insects. They do not need strong feet for walking, hopping, running or perching—and therefore the feet of all the four birds you have heard of are weakly, and indeed, in the case of the swift, almost useless. The swift's feet are no more than hooks! There is no backward-pointing toe

Top to bottom: THE SAND MARTIN. THE BARN SWALLOW. THE SWIFT. THE HOUSE MARTIN.

as other birds have, but all the toes point forward, so that the swift has great difficulty in balancing itself when on the ground.

However, it has no need to use its feet, for all the day long it is on the wing, quite tireless. It is marvellous to watch it in flight; it wheels here and there, it darts to the side to take a flying insect, it soars upward, it shoots forward, it races by so fast that we hardly see it go! It is master of the air, and some people say that it even sleeps on the wing! But for a few hours each night it hangs itself up by its hook-like feet and rests its wings in sleep—then at the earliest glimmer of dawn it is off again, strong and tireless, screaming with joy and delight.

I know a great many people who have nests of mud under the eaves of their houses, and they say to me that the swallows nest there year after year—but it is the house martins who nest there, not the barn swallows! That is why they are called *house* martins, because they love to nest on our houses. The barn swallows like to nest in barns and out-buildings. They seldom come to our houses to nest. The sand martins, as their name tells you, like a sandy place for nesting —an old sand-pit or a quarry. The swift will sometimes nest under the eaves of a cottage, but he prefers a lofty house or building, such as a church-tower.

Most of you know what the swallows and the house

martins use in the building of their nests. What is it? Yes—mud! The barn swallow chooses, perhaps, a beam in a barn, and on it he builds a saucer of mud, lined with feathers and soft grasses. If he places it against a wall he then makes it in the shape of a half-saucer, but these often fall, for they are not so securely built as the nests of the clever little house martin.

The house martin loves our houses. He likes to be near us, he likes to fly over our gardens. He builds his nest as close to us as he can, right under the eaves. His nest, too, is built of mud, and he lines it well with grasses and feathers. The nests are so well built that he can use the same one year after year, simply patching it up afresh each spring-time.

The sand martin burrows into a sandy bank. He may burrow two or three feet or more, and at the end he widens the tunnel and places straw and feathers there for his nest. He always makes the tunnel slope slightly upwards, so that if any rain trickles down through the bank, it will run out of the tunnel, not into his nest (see picture on page 39).

The mud for the swallow's nest and the house martin's is taken from brook-sides, pond-sides, or puddles in the road. The birds fly down, collect some in their beaks and fly off to their nesting-place. They press the mud against the beam or against the house wall and then fly off for more. If you see some small

birds very busy pecking about a puddle in the road, look carefully at them. They will probably be swallows or house martins collecting mud for their nests.

How is the swift to build his nest, for his feet are useless to him, so that he cannot fly down to the ground to collect nest materials! He does not mind—he collects all he wants as he flies! He sees a straw blowing in the air and he catches it deftly in his beak. He spies a feather blowing about. He catches that! He takes cobwebs too, and uses those, sticking all these frail, delicate things together to make a flimsy nest in which to bring up his children. The swift has one brood a year, unlike the swallows, who have two or three. The eggs are long in shape and dead-white.

The barn swallow's eggs are white with brown or grey spots. The house martin's are long in shape and pure white, and the sand martin's are also white, and rather thin-shelled.

The three swallows and the swift leave us in the autumn; indeed, the swift may leave us in August. They go to warmer lands, and often fly great distances. And yet, in some marvellous way, when they return to us in April they find their way back to the very village in which they themselves were born. Here they build their nests, or patch up their old ones, lay their eggs, bring up their young, and then once more, when the chilly evenings come, fly off in hundreds to lands where

insects are plentiful during our winter. You may see them gathering together in crowds on the telegraph wires or on the roofs of buildings, ready to migrate in a great army.

All the swallows and the swifts do us a great service in the spring-time, for they eat countless numbers of flies, beetles and moths. Any insect that flies is their prey, and when they have their young ones to feed they must catch thousands of insects each day. So we will welcome them joyfully, and hail them as our good friends when we see them flying in the air once more.

[*Eric Hosking.*

A SAND MARTIN AT THE ENTRANCE TO HIS NEST

I expect you have heard it said that when the swallows fly low, rain or bad weather may be looked for. Do you know why that is? Well, insects fly

high in dry weather, for the air is light and dry, but when the atmosphere is heavy with moisture they fly lower down. As they are the food of the swallows, the birds fly low after them—and thus it came about that people said, "The swallows are flying low, so rain is near!" Watch to see if this saying is true.

THINGS TO DO

1. Write these four things down to help you to remember the differences between the three swallows and the swift:

   A. The swallow has a steely-blue back, a chestnut breast, and a very long, forked tail.
   B. The house martin has no chestnut breast, not such a long tail, but he has a white patch on the lower part of his back by which we may know him.
   C. The sand martin is mouse-brown with white under-parts.
   D. The swift is sooty-black all over, and his wings are strikingly sickle-shaped. He often makes a screeching noise.

2. How does the barn swallow or the house martin build a nest?
3. Draw dozens of little swallows gathering together to fly away in the autumn.
4. Watch to see if the rain comes when the swallows fly low.
5. Watch the birds that skim about through the air or over the surface of the river or pond, and see if you can tell what kind they are—swallow, martin or swift.

CHAPTER 5

THE KEEPING OF CATERPILLARS

MOST of us keep caterpillars either at home or at school, and we love to watch the interesting little creatures feeding greedily on the food-plant, or changing their skins, or preparing to turn into chrysalids.

In this lesson I am going to tell you various ways of keeping them, and you will be able to choose which sort of breeding-cage you will have for *your* caterpillars this year. I shall tell you their life-history very shortly, and give you a few important hints on how to rear your caterpillars successfully.

A caterpillar starts life as an egg, usually on the under-side of some leaf. It is one of a large batch of eggs laid by a butterfly or moth. If we could look at these eggs under a microscope or magnifying-glass we should be surprised to see their pretty shape, and the lovely sculptured designs on the surface.

When the right time comes the eggs hatch out into tiny grubs. These usually eat their egg-cases and then start to feast on the leaves of the food-plant, whatever it is. Our caterpillar feeds greedily, until he becomes so fat that his skin looks too tight for him. It actually *is* too tight, and he splits it. Out he steps

with a completely new suit underneath, and begins eating once again. It does not matter how fat he gets, his skin will split time and again for him. He becomes very big and fat, and then one day he stops eating and seems ill-at-ease and restless. He knows it is time to change into a chrysalis. He finds a convenient spot, changes his skin for the last time, and either hangs himself up or buries himself in the ground, turning slowly into a hard-shelled chrysalis. If he is going to become a moth, not a butterfly, he weaves himself a silken cocoon. Then he sleeps for some time, and whilst he sleeps a magical change comes over him—he changes into a winged butterfly or moth. He awakes, splits his case and crawls out into the open air—a feeble, limp-winged moth or butterfly. He climbs up a stem, hangs there to allow his wings to dry, and then, when they are wide-spread and beautiful, flies off happily into the sunshine.

Such is the history of any of the little caterpillars we may find now—a marvellous story, and one we may watch for ourselves.

Country schools may have as many as two or three dozen different sorts of caterpillars, for the hedges and fields are near by, and all boys and girls like to hunt for caterpillars. For collecting them take a tin box with you, with tiny holes punched in the lid, and a layer of moss so that when you carry the grubs

home they will be protected by the softness of the moss.

Bring back with you a stem and leaves of the plant on which you found your caterpillar—unless it is something you can easily get at home, such as nettles or dock. Do not forget to do this, or to notice very carefully what your caterpillar was on, for it may die if you do not give it the right food. If you are lucky enough to find batches of eggs on a leaf, try to get the whole plant up so that you may plant it in a pot, and thus provide the caterpillars, when they hatch, with plenty of suitable fresh food.

Town schools may buy, very cheaply, the eggs or caterpillars of most of the common butterflies or moths; or a friendly country school will often be willing to send them on request.

Here are some hints about keeping caterpillars :—

1. They must have plenty of air, light and space. Do not keep a lot in one box or they will become diseased and die.

2. Give them fresh food every morning, unless their food is actually growing in a pot.

3. Clean their cage each day without fail.

4. At week-ends the most reliable children may take them home to care for.

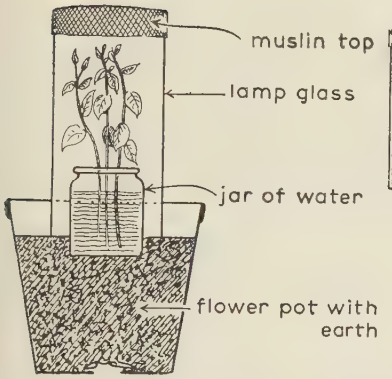
5. When you think the caterpillars are going to pupate, *i.e.* turn into chrysalids, provide them with

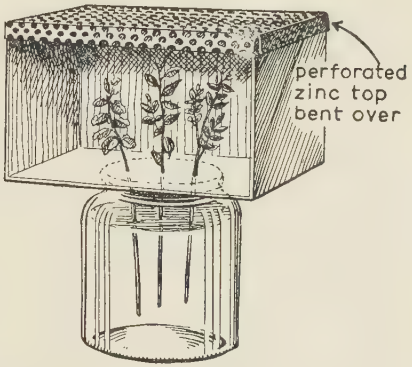
soil mixed with sand at the bottom of the cage, and a few dried leaves and small twigs, as many of them like to use these in pupating, and will crawl miserably round the cage and die if they cannot find what they need. If you know what kind your caterpillar is, look up your reference book, and it will probably tell you how your caterpillar pupates. A goat-moth caterpillar, for instance, likes soil, bits of twig, leaves and so on. A cabbage white, on the other hand, climbs up the rough side of the box or up a twig, and hangs itself there, suspended by a silken thread.

6. Do not disturb your caterpillars when they are pupating. When transferring caterpillars from one place to another use a small paint-brush, in case you squeeze the creature's body too hard.

7. When you know that your chrysalids are about to turn into moths or butterflies, be sure to provide a few upright twigs in their cage so that they may crawl up them in order to hang there and dry their wings. If you do not do this, the poor creatures will crawl round the floor of the cage in misery and will probably cripple themselves.

8. When your caterpillars pupate, keep the chrysalids out-of-doors in a shed or somewhere fairly cool and airy. They dislike being kept indoors. Even if you have to keep them through the winter, you may still keep them out-of-doors. Frost will not hurt them.





Left: FIG. 1.—A GOOD BREEDING-CAGE FOR CATERPILLARS, EASY TO MAKE. *Right:* FIG. 2.—HOW TO USE YOUR EMPTY CHALK-BOXES FOR CAGES (the side of the box is removed in the picture to show the construction of the cage)

There are all sorts of ways to keep your caterpillars. One of the easiest is that suggested by the Board of Education. I will quote what they say:

"A few inches of soil are placed in an ordinary flower-pot, and a small bottle filled with water is partially embedded in the soil, and shoots of the plant with the growing caterpillars are placed in the bottle. A wide lampglass with a muslin top rests on the soil and encloses the bottle and its contents. From time to time fresh food is introduced, and after the caterpillars have settled on this the remains of the old food are removed. All stages in the life-history can be readily followed." (See Fig. 1.)

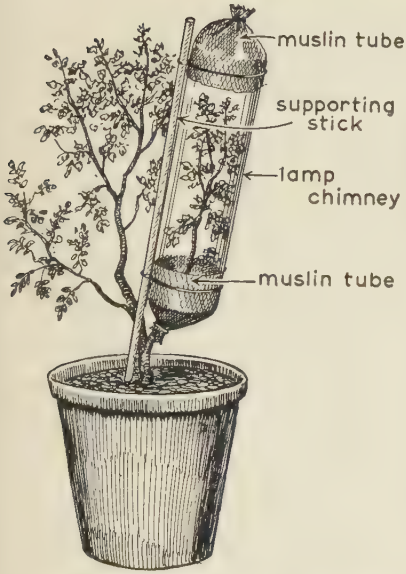
Your empty chalk-boxes will come in quite useful for breeding-cages. Take off the lid. Bore holes in

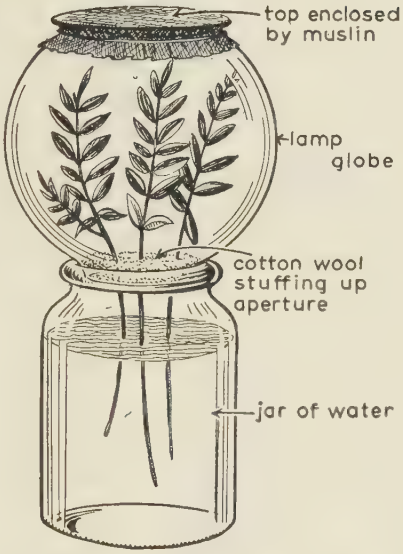
the bottom with a red-hot knitting-needle. Stand the box over a jar of water. Poke the stems of the food-plant through the holes in the box, down into the jar of water. Put your caterpillars on the plant. Place over the top of the box either a piece of net or muslin, when the caterpillars are very small, or a piece of perforated zinc, bent to fit the top of the box. (Fig. 2.)

When your caterpillars are small, and you have their food-plant growing in a pot, you will find it convenient to "sleeve" a branch of it, moving the apparatus to another branch when the caterpillars have eaten the leaves of the first. The picture (Fig. 3) will show you how to do it.

You will want a lamp-chimney and some muslin. Sew up two pieces of the muslin so that you make two tubes. Slip one tube over each end of the lamp-chimney. Now place the chimney carefully over the branch of the food-plant. Tie the muslin end to the plant stalk. Put in your caterpillars, if they are not already on the leaves, tie up the top of the other muslin tube, and there you have your "cage" of caterpillars, easy to see, and with plenty of light and air. You can slip elastic bands round the chimney to hold the muslin in place, or you may glue the muslin on to the chimney. Put a stick into the pot, and tie the lamp-chimney to it to keep it upright.

When you have the food-plant in water, not grow-





Left: FIG. 3.—HOW TO "SLEEVE" A BRANCH OF A PLANT TO MAKE A GOOD BREEDING-CAGE. *Right:* FIG. 4.—THIS IS AN EASILY-MADE AND EFFECTIVE CAGE

ing in a pot, you will want different "cages." Fig. 4 shows a jar of water on the top of which rests a wide lamp-globe. The food-plant sticks down into the water, but be careful to stuff up the opening of the globe (at the bottom) where the stalks pass through, with cotton wool, or your caterpillars will fall through and be drowned. Cover the top with muslin, which you can easily secure round the edge of the globe with an elastic band.

A second cage, bigger than the other, can be made

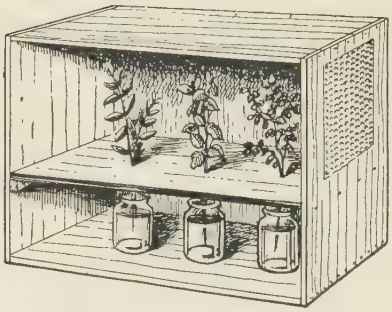


FIG. 5.

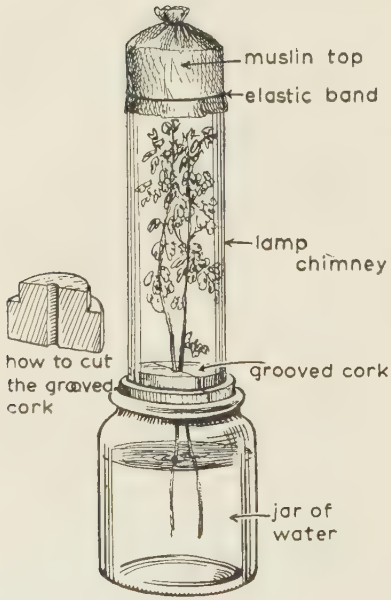


FIG. 6.

from a box. Look at Fig. 5, on this page, and see what an excellent observation cage it is. Fresh air is supplied through the holes in the strips of perforated zinc (which you can have at the back of the box, instead of the sides, if you wish). A little shelf is placed a third of the way up the box, resting on two strips of wood nailed along the sides. Holes are bored in this shelf to allow the stalks of plants to poke through. On the underneath are pots of water. The leafy part of the food-plants is on the top shelf, as you see, and the stalks go through the holes and stand in the water below. The caterpillars feed on the leaves on the top shelf. A sheet of glass is cut for the front of the cage. If the cage is of

a large size, three or four different food-plants may be provided, and different varieties of caterpillars will feed on their own food-plants, thus making the cage a most interesting sight to see.

For the caterpillar cage in Fig. 6 you will need a wide-mouthed jam-jar, and a thick cork to fit it. Get a narrow lamp-chimney, and then cut the top of the cork so that the chimney will fit neatly over it. Now cut the cork in half and make a groove in the centre of each face, so that when the cork is fitted together there is a neat hole in the middle of it through which the stems of plants may easily be passed. Cork up the jam-jar, previously filled with water, and place some sprigs of the food-plant through the hole in the cork, so that they stand in the water If any space is left between cork and stalks, stuff up with cotton wool.

Now slip on the lamp-chimney, fitting it over the top of the cork. Slip a tube of muslin over the top of the chimney, using an elastic band to hold the top together. Now you can see your caterpillars eating, and can be sure that their food is fresh and sweet.

THINGS TO DO

1. Write the story of a butterfly, from egg to perfect insect.
2. Draw pictures to go with the story.
3. Make one or more of the breeding-cages described and keep your caterpillars in it.

CHAPTER 6

FLOWERS FOR YOU TO FIND

THERE are at least 20 or 30 common flowers you ought to know by sight this term, not counting the very commonest, such as Daisy or Buttercup, which surely every child knows. I am going to tell you, very shortly, where to find these flowers and what they are like. You must look them up in your Flower Book (I hope you have all got one with coloured pictures in), and examine them well. Then off you must go hunting, and how proud those schools will be who can set up the whole array and name them!

I am going to suppose that you all know the following flowers: Hawthorn (May), Daisy, Buttercup, Dandelion, Gorse, Poppy, Thistle, White and Red Clover, Bluebell and Stinging Nettle. That is, we start off with 11 flowers we know already. But you must find them, please, and give them their names. Now we will hunt for those you may not know so well. I have put them in alphabetical order.

12. BLUE BUGLE. Look on banks and in fields. The deep blue flowers grow closely together from the top to the bottom of the stem. Look at the stem. It is pale purple and is four-sided.

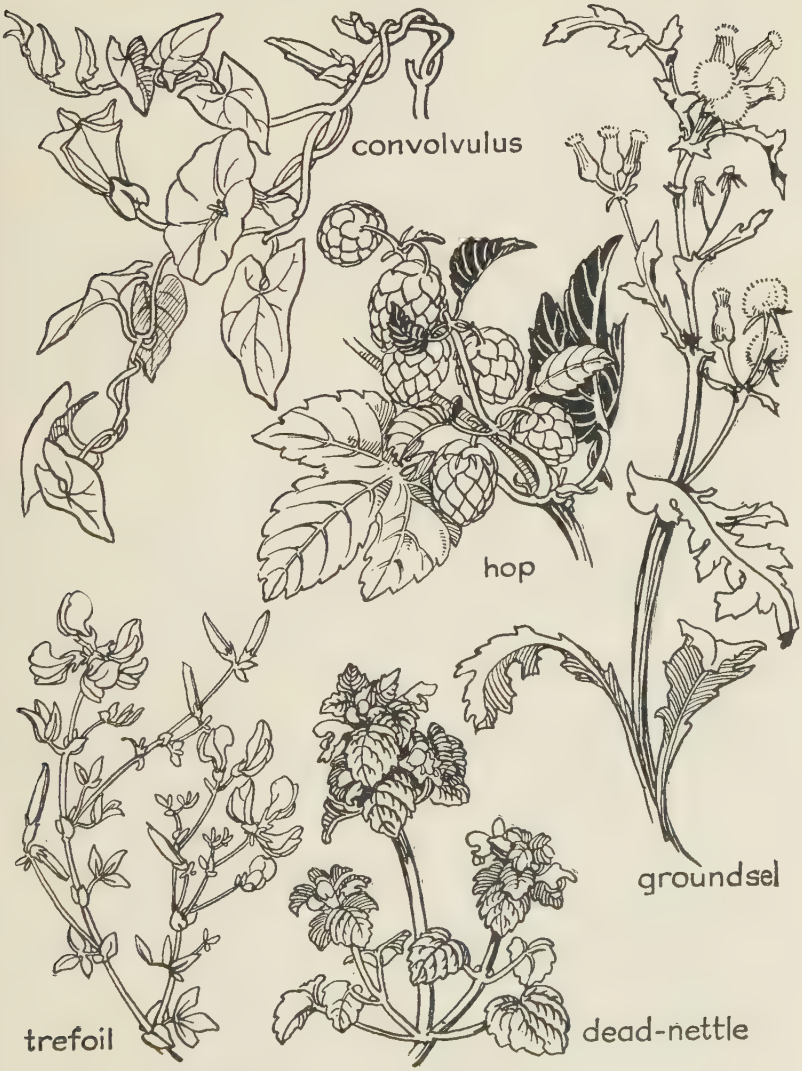
13. Bramble Flower. You all know the Blackberry bushes, don't you? Look for the early Bramble flowers on the bushes in late June. They may be white or pink.
14. Birdsfoot Trefoil. This grows in fields, woods and waste places, and the golden-yellow flowers have orange streaks in them. The flowers are sweet-pea shaped, and grow in tufts at the end of the long flower-stalk. Trefoil means three-leaved, but if you count the leaflets on each short stalk you will find there are five. The name Birdsfoot comes from the seed-pods, which, when they are ripe and hang down, look like the bunched-up claws of a bird. You perhaps know this flower by the pretty name of Shoes and Stockings.
15. Common Agrimony. Look for this plant in dry places, such as hedge-banks or by field-paths. It has bright yellow flowers growing in long, tapering spikes. The lowest flowers come out first, their clusters of five petals looking like small stars.
16. Cow Parsnip. This hedgeside and meadow flower belongs to what we call the Umbrella Family! At the end of the stem the flowers are borne on stiff, umbrella-like spokes, and if you imagine the stem to be the handle of the umbrella you will see that the spokes at the end look rather like an umbrella that has blown inside out. There are a

good many plants belonging to this family, and you will always be able to recognise them by their "umbrellas." The Cow Parsnip has a flat mass of small white flowers held by the umbrella spokes. It is a tall plant, as big as you, with a stout, hollow stem, in which little insects hide in winter.

17. Dead Nettle. (White.) Many people muddle this flower with the Stinging Nettle, but you may easily tell the difference by looking for its pretty white flowers. The Stinging Nettle has green flowers and dark green leaves. The leaves of the Dead Nettle are paler. They grow in pairs up the stem, and the pretty white, tube-shaped flowers grow in circles round the stem, beside the leaves.

18. Dove's Foot Crane's Bill. This small pink flower can be found easily by the wayside all the summer through. It has geranium-like leaves, which are soft and downy. Look for the curious beak-like seed-vessels, sticking boldly upwards when the flowers die. These give the plant its curious name of Crane's Bill. The stem is weak and lies near the ground. *Herb-Robert* is a common cousin of Dove's Foot Crane's Bill, and you may tell it by its stronger stalk and lovely red leaves, very much cut up.

19. Field Convolvulus. (*Bindweed.*) Look for this



SOME COMMON FLOWERS YOU SHOULD KNOW

little flower in fields, waste places and banks. It has pale pink or white flowers shaped like a pretty wide-open bell. The leaves are arrow-shaped. Look at the stalk—it twists itself round other plants, and often strangles them.

20. FUMITORY. You will find Common Fumitory in waste places and fields. It is a dainty-looking plant with finely-cut, delicate, grey-green leaves and pretty rose-pink flowers. These are in clusters, and each little flower puts out what looks like a small pink tongue.
21. GROUNDSEL. If you have a canary I expect you know this plant, for canaries love to peck at the little seeds. The small yellow flowers look like little shaving-brushes, crowded together in clusters. The leaves are dark green and glossy, shaped like feathers. Look for Groundsel in any waste place. It flowers all the year round.
22. GROUND IVY. In hedges, waste ground and by the wayside you will find this very common little plant, with its purple-blue tube-like flowers and kidney-shaped leaves growing at intervals all the way up the stalk. I cannot tell you why it has such a strange name, unless it is because it rather likes to trail about, like ivy.
23. GOOSE GRASS. (*Cleavers.*) You do not need to see the flowers to recognise this clinging plant

with its square stem set with hooks that catch hold of other plants. Its long, narrow leaves also have hooks growing on them, and these catch hold of our stockings as we pass. The flowers are small and white.

24. HEMLOCK. This is a poisonous plant, and you should know it so that you can avoid it. It belongs to the Umbrella family, like the Cow Parsnip, and you will see a family likeness between them. There are the same clusters of white flowers at the end of the umbrella spokes, but beneath each cluster of flowers you will see three little pointed leaves, all turning to the same side. Now look at the stem, which is spotted with purple-pink and is perfectly smooth, not hairy. It is a tall plant, with finely-divided, fern-like leaves. You will find it by the wayside, by the hedge and in open woods.

25. HOP TREFOIL. Look for this dainty little plant at field edges and in meadows. It has small round yellow heads just like a tiny clover, and its leaflets are in threes, like a well-spaced shamrock leaf.

26. JACK-BY-THE-HEDGE. (*Sauce-Alone* or *Garlic Mustard.*) A plant about two feet high with delicate green, heart-shaped leaves, and small, very white flowers. When picked it smells like garlic, and is most unpleasant. It is found in the hedges.

27. Lady's Fingers. You are sure to find these showy yellow flowers growing in fields and on warm banks. In shape the flowers are rather like the Birdsfoot Trefoil, and are grouped together, twenty or thirty at a time, at the end of a sturdy stalk. The yellow flowers have rather a woolly appearance owing to the down on the sepals.
28. Lords and Ladies. (*Cuckoo-pint, Wake-Robin.*) You are certain to know this strange plant with its great sheath of green, enclosing a club-shaped red or purple tongue. It grows in the hedges.
29. Mayweed (Scentless.) This is a very common daisy flower, not so big as the Ox-Eye Daisy, or so stiff, but bushier. Look at the yellow centres of these daisy-like flowers and see if you can find some that look very queer. Do you see how the white strap-petals droop down when the flower is over, and how the yellow centre has arched itself up like a yellow thimble? It is very quaint-looking. The green leaves are finely divided, almost hairlike. You will find the Mayweed in fields and by the wayside.
30. Ox-Eye Daisy. This big field daisy is too well known to need many words. It is a sturdy, handsome plant with feather-shaped leaves, and is often found mingled with the buttercups.
31. Pansy. (*Heartsease.*) The wild pansy is just like

COMMON FLOWERS YOU WILL FIND IN THE FIELDS AND HEDGES

a tiny garden pansy, usually yellow in colour, tinged with purple. You will generally find it growing in cultivated fields.

32. Pimpernel. This is one of our few red flowers. It is brilliant scarlet, the small flowers growing on little stalks that spring out from where each pair of leaves grows. You will find it growing in waste places, by the wayside and in cultivated fields.

33. Red Campion. This is a pretty plant with a liking for damp places, such as the hedgeside. Its rose-coloured flowers have five petals, cleft halfway down as if someone had taken a bite out of them! If you look inside the flowers you will see that they will either have stamens but no pistil, or pistil but no stamens. The Red Campion has an untidy cousin, *Ragged Robin*. If you see a plant with rose-pink petals that look as if they have been slashed into rags, you will know it is Ragged Robin.

34. Ribwort Plantain. Perhaps you have played at "Cocks and Hens" or "Soldiers" with this plant? You pick the brown, cone-shaped flowerheads by their long, ribbed stalks, and first one of you and then the other tries to strike off the head of the flower with your own flower. When the Plantain is in flower it is very pretty, for the whole brown head is full of showy yellow stamens.

The leaves, narrow and pointed, dark green on one side and grey-green on the other, are ribbed all the way up. That is how the plant gets its name. You will find it easily in the fields and meadows.

35. Shepherd's Purse. You will probably know the Shepherd's Purse, not by its tiny white flowers at the top of its stalk, but by the heart-shaped little "purses" growing all the way up the stem, the seed-boxes of the flower. There are two kinds of leaves, one kind forming a rosette on the ground, the other kind arrow-head shaped, growing up the stem.

36. Speedwell. Along the hedge-banks you will find a small bright blue flower, which perhaps you know by the name of Bird's Eye. The petals are four in number, and in the midst of each is a tiny white circle, like a minute eye. The flowers grow in tapering clusters, often very near the ground, for the Germander Speedwell has a habit of creeping before it grows upwards.

37. Sorrel. The dull crimson spikes of the Common Sorrel can be found almost anywhere, but perhaps they are prettiest to see when mixed with the golden buttercups and white ox-eye daisies. They stand up above the daisies, tall spires of tiny, dull-red flowers. The leaves are arrow-shaped.

38. Tormentil. You may often have seen this dainty

yellow flower growing on banks and in woods. It has four pale yellow petals, which it opens wide, and its leaves are cut into five fine fingers.

39. Vetches and Vetchlings. You are sure to find many plants with purple or yellow sweet-pea shaped flowers, climbing upwards by means of tendrils. There are all kinds. One of the prettiest is the Tufted Vetch, which has its narrow, silky leaflets in about ten pairs. It strews its spikes of bluish-purple flowers all over the hedges as it climbs.

I have no more space to describe to you further flowers you should know—but the 39 above will be quite enough for you to find this summer. For those who already know most of them, here is a short list of further flowers to hunt for :—Wild Clematis (Travellers' Joy or Old Man's Beard), Black Bryony and White Bryony, Purple Loosestrife, Wood Spurge, Yarrow, Beaked Parsley, Broom, Foxglove, Mullein, Corn-Cockle, Marigold, Mallow, Rest Harrow, Wild Carrot, Toadflax, Meadow-Sweet and Wild Hop.

CHAPTER 7

THE STORY OF THE BEE

I REALLY need a whole book to tell you the story of the bee; it is such a wonderful tale, and there is so much to say. I will just tell you what I can, and hope that you will be interested enough to find out more for yourself later on.

The bee has a marvellous body. It has two pairs of wings, and these are neatly fastened together by rows of tiny hooks when the bee flies. Its tongue is wonderfully made so that it may take the nectar from the flowers. Have you ever watched a bee thrusting its tongue into a flower? Its body is covered with hairs that brush the pollen from the stamens, and on its hind-legs are pollen baskets or pockets, fringed with stiff hairs that comb the pollen from the bee's body into the pockets.

You know that bees help the flowers to make their fruits, don't you? A flower cannot make good seed until it has pollen from another flower brought to it—and this the bees do. Plants that are grown in greenhouses into which bees cannot find their way have to ask *us* for help. My greenhouse tomatoes, for instance, must have *my* help in brushing pollen from one flower

to another, or they will not grow their ripe red fruit for me. But the outdoor tomatoes are pollinated by the busy bees, and I do not need to take my little paint-brush to them as I do to the indoor ones.

The flowers give the bees pollen and nectar. The nectar is changed to honey by the bees in a very marvellous way. They take both pollen and nectar back to their hives for food for themselves and for the baby bees, and they also store it up for the winter, when no flowers bloom.

From the pollen and honey they make a mixture called Bee-Bread, and on this the young bee-grubs are fed. They are also given a food called Royal Jelly, but they only have this at first. A grub fed entirely on Royal Jelly becomes not a worker-bee but a queen-bee. It is strange that a difference in food means either an ordinary bee or a royal bee, isn't it?

I expect you know what a hive is like from the outside; it is a neat wooden box on legs, and it takes to pieces so that the honey may be easily removed. Thousands of bees live in the hive, and most of them work hard all day long.

Sometimes people keep bees in the old-fashioned straw skeps. The bees do not mind where they live so long as there is plenty of room to bring up their children and store honey for the winter. Have you a section of honeycomb to see? That is taken from a hive.

BOYS AND GIRLS LEARNING ABOUT BEE-KEEPING AT THEIR SCHOOL, WHERE A HIVE OF BEES IS KEPT

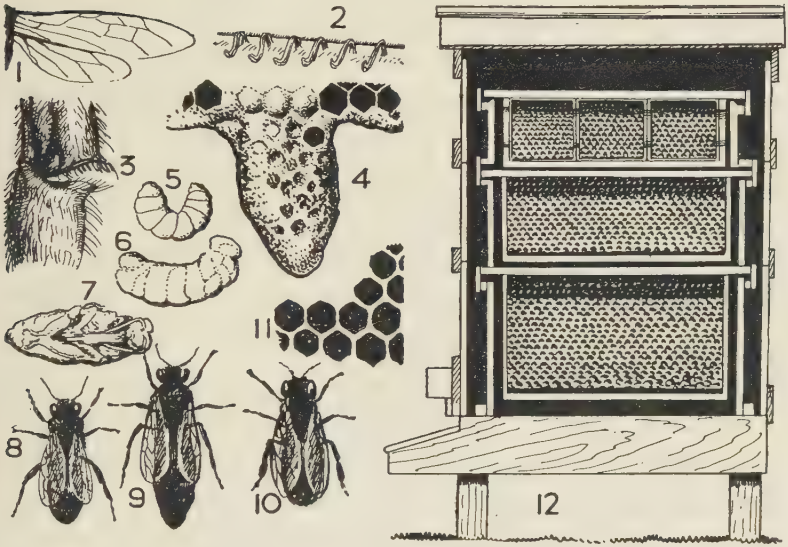
Look at it closely. Do you see the cells filled with honey? Doesn't it look delicious? The bees packed it in those cells. Who made the cells? The *wooden* section was certainly made by a human being—but

those delicate waxen cells were bee-made. How many sides have they? Count and see. There are six to each cell. A collection of six-sided cells cleverly uses every bit of space available without wasting any. *Round* cells would waste a good deal of space. The cells are made of wax, which the bees make out of their own bodies.

If we could make ourselves very small and creep in at the hive-entrance with the bees, we should stand and gaze in amazement at the busy city inside. There would be bees rushing all over the place. Some would be putting honey into cells. Others would be feeding the small bee-grubs, each in its waxen, six-sided cell. Then we should see some bees standing and whirring their wings, making a draught. Why do they do that? Simply because the hive is too warm, and so some of the bees are given the task of cooling it!

Other bees act as the hive's dustmen. They go about cleaning up the hive and removing anything dirty or unnecessary. The hive must be kept clean as well as cool, for dirt might bring not only discomfort but disease. The hive is like a well-ordered town.

In the hive there are three different kinds of bees. There is the small, ordinary bee we know so well—busy, hard-working, most industrious. There are thousands of these worker bees in the hive. Then there are bigger, fatter drone bees who do nothing.



THE BEES AND THE HIVE WHERE THEY LIVE

1. Upper and lower wings of honey-bee. 2. Hooks that hold together the two wings in flight. 3. Pollen pocket in joint of leg. 4. Royal cell. 5. The grub. 6. Grub spinning its cocoon. 7. The pupa. 8. A worker-bee. 9. A queen-bee. 10. A drone-bee. 11. Section of honeycomb. 12. Section of a hive.

They have not even leg-baskets to put pollen in. They do not go out for nectar, they do not help in any of the work of the hive. They beg the busy worker-bees for food. One of them will some day be the husband of the queen-bee, but otherwise they are useless.

The third kind of bee is a big bee, very long in the body—so long that her wings only come halfway down her back. This is the queen-bee. We shall only see one in the hive. She does a most important work.

She lays thousands of eggs in the cells made by the worker-bees. You may easily know the queen-bee by the way the other bees attend and respect her. She always has a bodyguard, and if she comes near to a crowd of bees they make way for her so that there is always a clear space for her to walk in. She is very important and much honoured. Without her there would be no eggs. The worker-bees feed her well, and when she has laid an egg in an empty cell they watch over it carefully.

They keep the egg warm in its cell. In three days it hatches out into a small white grub. The worker-bees feed it first on jelly and then on bee-bread—honey and pollen mixed together. In a few days the grub is so big that it takes up all the room in its cell. Then the bees put a lid on the little cell and the grub is a prisoner. It spins itself a thin cocoon and goes to sleep. While it sleeps it changes from a grub into a bee. In a week's time it eats a hole in its cocoon, opens the lid of its cell and walks out—a soft, wet bee, ready to take its place in the busy hive and work as hard as all the others.

As the summer goes on, the hive gets overcrowded and the queen takes some of the bees away to find a new home. This is when the bees swarm. The air seems suddenly full of a shrill whirring sound—the noise of thousands of bees humming excitedly—and

from the hive pour out masses of bees, all eager to follow the queen. She usually flies to a branch of a tree near by, and there she and a great cluster of bees wait until her scouts return to tell her of a good place for a new hive—perhaps a hole in a wall or in a hollow tree.

But meanwhile the bee-keeper is busy—he does not mean to lose his bees! He gets a new hive ready, and if he takes the swarm successfully he now has two hives where before he had only one! The bees settle down in their new hive and start their work as busily as ever.

What about the hive that was left? It now has no queen. What will become of it? Well, when the bees increased in number, and the workers guessed that a time would come when the queen would fly away with a party of her own, they prepared some special, big cells for princess-bee eggs. The queen laid eggs in these cells and the workers fed the grubs on special royal jelly. When the queen at last flew off with her party of bees, the workers who were left waited for the first princess-bee to hatch.

As soon as she crawled out of her cell she went to the other royal cells and stung the princesses there to death. There can never be more than one queen in a hive. Then this princess became queen and went on with the business of laying eggs in the hive.

If a queen should die and there are no princess-bees

to hatch, the bees take a worker-bee grub and feed it on the royal jelly. They make the cell walls longer, and lo and behold, the worker-bee grub grows into a queen-bee!

A SWARM OF BEES CLUSTERING ON A GARDEN GATE

The drone-bees have a short life. They do not live through the winter as the other bees do. They have taken no part in the work of fetching and storing honey for the winter, and so, when winter is near, the worker-bees will not let them live to feast on honey that others have gathered in. So they fall upon the startled drones and bite off their wings. Then they cast them out of the hive to perish in the cold autumn. Poor drones—they cannot work if they would. They have an easy life but a short one.

The bees store far too much honey for their own

use. There is plenty over for us, and we take it and spread it on our bread and butter for tea.

We all like the little honey-bees, but perhaps most of us like best the big, blundering humble- or bumble-bees. They are so big and furry, they seem such jolly, good-natured fellows, humming loudly as they go booming in and out of the flowers. These, too, have a life rather like that of the ordinary bee. The queen makes a nest and lays eggs somewhere in a bank, in a heap of stones, or in a hole in the thatched roof of a house. As soon as the eggs hatch out the young bees start work and help the queen to fetch honey and to build more cells. They are worker-bees. Later on in the season drones and princess-bees are hatched out. The humble-bee does not store honey for the winter—only for the wet, cold days of summer-time. At the end of the season the drones and the workers die. Only the queen-bee and the princesses live on, finding a warm corner somewhere in the ivy or in a hole in a wall; each of them will make a nest the next summer.

THINGS TO DO

1. Write down the three different kinds of honey-bee and say what each does.
2. Pretend you are a bee in a hive, and say what you see going on around you.
3. Draw a piece of honeycomb, remembering to give each cell six sides.

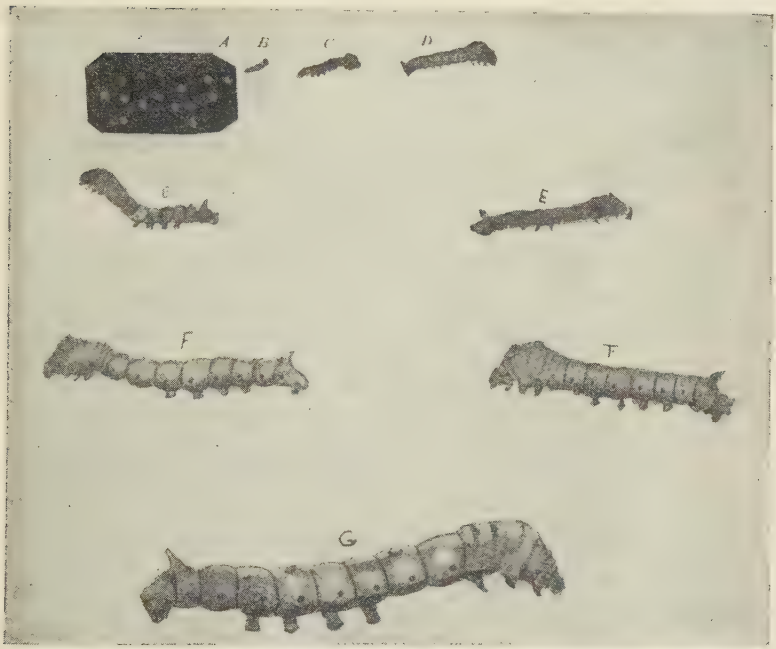
CHAPTER 8

THE KEEPING OF SILKWORMS

I HOPE that all of you are keeping silkworms this year. The eggs are very cheap to buy—you can easily get a hundred for a shilling—and it is great fun to watch the caterpillars feeding, growing, changing their skins, and spinning their wonderful cocoons, from which come the silk-moths.

May is the month for hatching-out the eggs, so if you have none you can perhaps buy the young caterpillars to watch. I am going to tell you the best way to keep them, so that you may have healthy, strong silkworms, and fine silken cocoons.

The eggs are the size of a pinhead, round and flattened. The tiny silkworms inside eat their way out of the egg-shell, and when they are hatched they look like short bits of black thread. Sometimes they cannot get rid of the shell, bits of which stick to their bodies and annoy them. In order to help them to get rid of the bits some people place a sheet of drawing-paper over the caterpillars, and in the paper they make tiny holes. On the top of the paper are put fresh leaves. The caterpillars make their way to the leaves through the little holes in the paper, and as they crawl through



A SILKWORM'S GROWTH

they scrape off the bits of shell still clinging to them. Then they begin to feed on the leaves.

As you perhaps know, silkworms like the leaves of the mulberry tree better than anything else—but they will feed eagerly on ordinary lettuce, so you will easily be able to supply them with fresh food. Cabbage lettuce is better than cos lettuce. Use the outside leaves, and be sure to wipe them dry before you give them to the caterpillars. Do not give them

mulberry leaves occasionally for a "treat"—if you do you will find that they like them so much they will not touch the lettuce again!

If you *are* lucky enough to have a mulberry tree growing near by, you will, of course, give your silkworms mulberry leaves always, not lettuce. If you do, you will find that the task of cleaning out the box is much easier, for caterpillars fed on mulberry leaves only leave dry litter for you to clear away, whilst those fed on lettuce leave moist and unpleasant litter.

You must, of course, clean out and feed each day. How are you keeping your silkworms? I keep mine in two or three cardboard-box lids—not in the boxes themselves, but just in the shallow lids. You do not need to cover your silkworms, for they do not wander as ordinary caterpillars do. They are "tame" because they have been fed and cared for for so many many years. So all you need is a shallow lid, with the sides about an inch or so deep. Keep them in an airy place, but not in a draught. If you put them on an open window-sill, watch that no birds come along to steal them! You will have to cover them with muslin if they do.

You will probably find that your silkworms hatch out at different times, so that you will have caterpillars of different sizes. You can keep the youngest ones in one lid, the next size in another lid and the oldest ones in a third lid. Keep an empty fourth lid to use

when cleaning out the other lids. You will find it best to remove the silkworms to the fourth lid when cleaning out their dirty lid.

How are you going to move them? You must be very careful or you will hurt their soft bodies. As soon as you get to school in the morning you must put a fresh leaf or two in the silkworm's lid, the one they are feeding in. In a short while most of the grubs will have walked on to the new food. Now you can carefully pick up the new leaves and put them in the empty lid, caterpillars and all. If there are a few silkworms still left in the old lid, use a camel-hair brush to move them gently on to a new leaf, and then pick up the leaf and remove it to the other lid. You will find it a good plan to print the number of silkworms on their lid, and count them as you move them, or else you may find you have thrown one or two away with the litter and dead leaves.

Now clean out the old lid, and place fresh food there, returning the silkworms when you are ready. Remember that you must never give them old, dry leaves—always fresh, tender juicy ones. One of you must see to them at the week-ends, of course; somebody careful and trustworthy.

Perhaps when you go to look at your silkworms you may see a few that look as if they feel ill. They will not eat—but we need not be alarmed, they are only

going to change their skin! They do this for the first time when they are about a week old. You must watch a silkworm changing its skin if you can. It is really very interesting to watch the skin split and the caterpillar work its way out of it. If you have a magnifying glass you must use it, then you will see everything very easily.

After the silkworm has changed its skin (a brand-new one appears under the old one!) it seems tired and exhausted and takes a rest. Then off it goes in a hurry to feed again and grows very quickly indeed.

Count how many times your silkworms take off their old skins. They will do it four times as they grow. How they eat! They really do seem greedy, and it is no wonder their skins burst! They soon lose their black colour and change to a pearly grey. They grow to a big size, two or three inches long, and it seems impossible that only a few weeks back they were like tiny bits of black cotton.

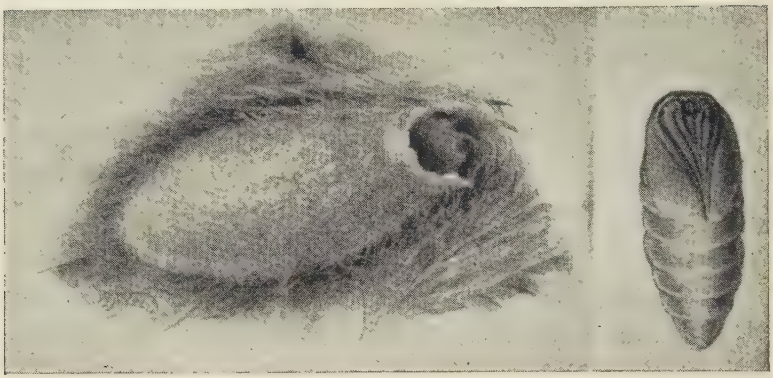
Cleaning and feeding becomes quite a business after four or five weeks, and we must never miss a day in our care of them. After six weeks some of the silkworms begin to look different. They seem to have shrunk a little and they look rather transparent. They will not eat and they raise their heads, shaking them and moving them about as if they felt giddy.

The time has come for them to change into a

chrysalis. First they were eggs, then they were caterpillars—and now the third stage of their life is near. After the fourth moult the silkworms ate more greedily than ever. They were amazingly hungry—they needed a great deal of food to prepare them for the time when they could not eat any more. Now that time has come.

They try to climb upwards. If we have put any twigs in their box they climb up those. Watch for this time and prepare cone-shaped bags for them of paper—coloured blotting-paper is best. Twist up the paper as you have seen the grocer do, and gently put the silkworm into it. Prepare as many bags as you have silkworms. Write on each bag the date on which you put the caterpillar in. Now pin the bag up on the wall, but first of all place underneath it a sheet of paper, because when the silkworm begins to spin in the bag some water flows from it, and this may mark the classroom wall if we are not careful.

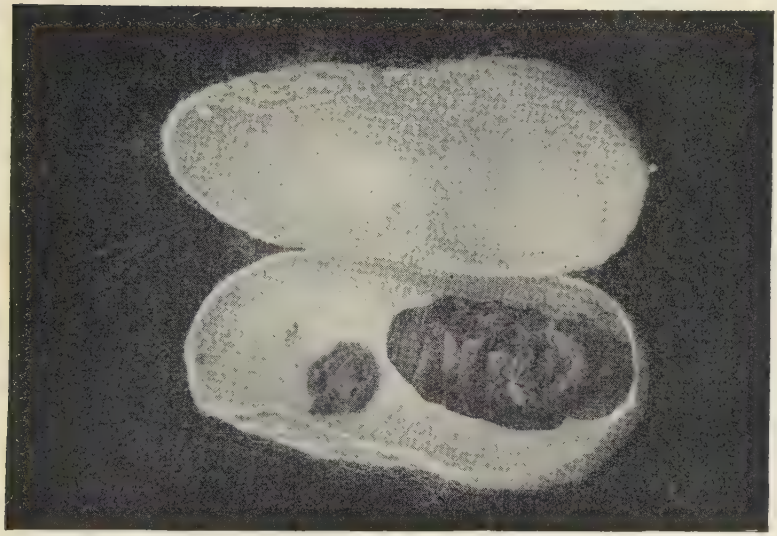
Now the silkworm begins its most interesting work—it spins a cocoon of real silk, fine and fairy-like. We can watch it spinning. Look into the paper-bag and see it moving its head continually to and fro, to and fro. A thin thread of silk is coming from its lower lip. Can you see it? Use a magnifying glass if you have one. First of all, the silkworm fastens itself to the bag—then it begins to make its pretty oval cocoon.



Left: THE COCOON, SHOWING THE HOLE FROM WHICH THE SILKWORM MOTH CAME OUT. *Right:* THE CHRYSALIS

To and fro goes its busy head, winding the silk round itself. At first we can see it quite clearly, then it can just be seen behind a thick veil of silk, and at last we cannot see it at all, for it is hidden in ever-thickening silk. After three or four days the cocoon is finished. There it lies in the bag, a beautiful golden case (or perhaps greenish or white, depending on the kind of silkworms we have—but usually the cocoons are deep gold).

Inside the silken cocoon lies the silkworm. It has changed its skin there for the last time—and this time its new skin is different. It has no mouth, no legs. It is not nearly so long as it was. It is soft, and is yellowish-white. In fact, it is no longer a caterpillar, but a chrysalis. Its skin soon becomes



A COCOON CUT IN HALF TO SHOW THE CHRYSALIS INSIDE

hard, like a shell, and it turns a red-brown colour. It lies still and does not move—but inside that shell great and amazing changes are taking place.

Sometimes, after a silkworm is placed in the bag to make its cocoon, it will not rest there, but tries to get out. In this case it is probably not ready to spin, and should be replaced in the box and allowed to continue eating, if it will.

Do you want to wind off the silk to see what it is like? You must wait for a week. Then take out the yellow cocoon from the bag—isn't it pretty? Pull off the loose outer silk, and find the end of the one long

thread that the silkworm used to spin its cocoon. Have you found it? Now take a doubled-over piece of stiff paper, about 3 inches wide, and, taking the end of the silken thread, wind the silk round and round the paper. As you wind it, and the threads lie over one another, you will see how fine yet strong the silk thread is, and what a lovely colour. It will take you a long time to wind off the silk. The cocoon becomes smaller and smaller as you take the silk, and at last there will be nothing left but the little hard-shelled chrysalis, together with the last cast-off skin of the silkworm. The cocoon will be gone—you have wound it all off on your paper! Of this silk are our dresses, stockings and many other things made. Isn't it strange to think that so many millions of caterpillars work to give us clothes of pure silk!

Inside the chrysalis a swift and curious transformation is going on. The one-time caterpillar is changing into a moth. At last it is ready to come out from the cocoon. It has no mouth, so it cannot bite its way through the silk—but it has in its head two little glands which contain what is called a solvent liquid—a liquid that flows out and loosens the silken threads of the cocoon, making a hole for the moth to creep from.

The moths are cream-coloured, their wings marked with wavy, faint brown lines. Their bodies are stout

A SILKWORM MOTH

and look furry. They stand on their cocoons, drying their wings, and we can tell which are male and which are female by the size. The females are the bigger moths.

Now you must get ready a box and line it with paper. Put the moths in the box, without the lid. They cannot fly and will not wander. They have no mouths, so you do not need to give them any food. Just leave them alone in a shady place.

They will lay their eggs for you—hundreds of them! Then, their work done, they will die peacefully. Take out the lining-paper from the box, cut out the patches of eggs and leave them exposed to the air for a few days. Then put them away in a cool

place until next year, when once more you will have eggs hatching and will have the interest of watching the life-story of silkworms once again.

THINGS TO DO

1. Buy some silkworms if you have none.
2. Draw them once a week on a silkworm chart. Put the dates.
3. Clean their box and feed them every day.
4. Watch to see when your silkworms are ready to spin their cocoons. Prepare cone-shaped bags for them and put them there.
5. Wind off the silk from a cocoon.
6. Keep the eggs laid by the silkworms, and watch them hatch next year.

CHAPTER 9

SOME TREES YOU SHOULD KNOW

I HAVE told you of some common birds you should know and flowers you should find—now I am going to tell you some trees to look for. It is easy to name them in summer-time because they have their leaves —it is more difficult in winter.

The Hawthorn

A tree you are sure to know, because of the lovely may-blossom it bears. It is very often found in the hedges as a bush. Look at the branches. You will see that they are set with sharp thorns. The leaves are a pretty shape, divided into blunt fingers. They are glossy and dark green in colour. See if you can find the little clusters of green knobs that will turn into the bright red haws so much loved by the birds in the winter.

The Horse-Chestnut

Another well-known tree, easily recognised in May by the beautiful white or pink spires of blossom it bears, making the chestnut look like a giant Christmas tree set with candles! I expect you had the buds in

your schoolroom this spring—fat and sticky. The leaves are cut into five or seven pear-shaped fingers, which turn brown, yellow and red in August. What is the fruit of this tree? I am sure that every boy and girl knows the brown, satiny "conkers" in their prickly cases.

The Lombardy Poplar

This is another tree most of you will know because of its spire-like shape. All its branches are held upright, instead of sideways. You have heard the old story, I expect, of the crock of gold that was given to the tree to hide? It was so anxious to hold it safely that it held its branches upright, close to the trunk, to prevent the crock from falling or from being seen.

The leaves are heart-shaped with a wavy margin, and are dark green. You may not be able to pick any, as they may be too far above your head, but you will easily be able to see their shape. They turn a beautiful yellow in the autumn.

The black poplar spreads its branches outwards, and has leaves of similar shape.

The Hazel

Country children will know this tree well, because of the delicious nuts it bears! It looks more like a big bush than a tree, because very often it has no central

CAN YOU FIND ALL THESE DIFFERENT LEAVES WHEN NEXT YOU GO FOR A WALK? SEE IF YOU CAN!

trunk, but merely a cluster of upright-growing branches. This is the tree that shakes out the yellow "lambs-tail" catkins in the early spring.

The leaves are large, irregularly heart-shaped. They are deep green in the summer and turn to a pretty golden-brown later. Look for the little green nuts, already forming for the autumn.

The Willows

There are too many kinds of willow trees for me to tell you them all. Did you get some palm for Palm Sunday? Well, the tree you cut your palm from was the Goat Willow. Find it again, and look at its pretty oval leaves, dark and shiny above and paler beneath. How different the tree looks now from the time when it stood clothed in golden pussy-catkins!

The Weeping Willow is easy to recognise, because it has graceful, whip-like branches drooping downwards. The leaves are long and narrow.

The White Willow is the largest of the willow family. You may know it by its silvery look, due to the silky surface of its leaves, which are the typical willow shape, long and narrow.

Your cricket bats are made from willow wood. Lobster-pots are made from the pliant withy or willow branches. Have you seen Pollard Willows? They are trees with short, stout trunks growing usually by

the stream or canal-side, and they have had their branches so continually lopped that their heads are nothing but a shock of long, slender shoots.

The Silver Birch

You will know this tree by its long thin trunk and its pretty silvery bark. It is a graceful, fairy-like tree, and its silvery trunk gleams like grey satin. The Red Indians use birch bark to cover their canoes, because it is practically indestructible. The leaves are very small, glossy and oval-shaped. Look for the little winged seeds.

The Oak

This is a grand tree, sturdy and strong. Look at its rough, knobbly trunk and branches. See its pretty feather-shaped leaves, so unlike those of other trees. They are dark green and glossy. Can you see any old acorn cups under the tree? Pick them up and see how prettily patterned the cups are. The "oak-apples" you see on the oak are not the fruit of the tree (which is, of course, its acorns), but are due to insects.

The Beech

This is perhaps the most beautiful of our trees. If the oak is King of the woods, the beech is Queen. Look at its trunk and see how tall, straight and smooth it is, and what a lovely green-grey colour. You will

easily be able to see the leaves and pick some, for the beech branches sweep almost down to the ground. Do you remember how sharp and pointed the leaf-buds were in the spring? The leaves are oval with a pointed tip and wavy margin. They are thin leaves, smooth, with very straight veins. In the autumn they become such a glorious tawny-brown that we pick them to decorate our classrooms. Look under the beech and see if you can find last year's seed cases.

The Elm

This tree grows to a very great height. You may know it by the large amount of brushwood growing all round its trunk, giving it an uneven, irregular shape, but very pretty. Look at the rough trunk with its deep cracks and grooves. The leaves are small for such a large tree and feel coarse and rough to our fingers.

The Ash

You may tell the ash tree by the colour and straightness of its trunk. It is ashy-grey, as you may guess from its name. Do you remember the coal-black buds it had in the spring-time? Out of those hard black buds have come thousands of pretty, feathery leaves. Look at them closely—you will see that each leaf is cut up into many pairs of graceful leaflets, lance-shaped, and toothed round the edges. All the leaflets sit on

one central stalk. Do you know the fruit of the ash? Look for the tufts of "spinners" or "keys" later on.

The Lime

You may often see in towns a row of trees down a street, with their branches cut off so that all they have left is an ugly, knobbly head, from which later on spring new shoots and twigs. These pollarded trees will be limes. When they are allowed to grow into their own shape they are pretty trees, with very dark, rather smooth trunks. The leaves are very bright green, large and heart-shaped, toothed all round the edges. Look for the queer blossoms—little clusters of yellowish-white flowers whose stalks join on to one long stalk that springs from a long green bract. The fruit looks like a bunch of downy balls.

The Sycamore or Great Maple

Do you know the sycamore "keys" that spin round and round in the air in the autumn? They are the winged seeds of this tree. Look at the leaves and you will see that they are large, shaped like a hand, with five blunt fingers sticking out. They are coarse, rough leaves. The trunk is grey and rather rough.

The Plane

You may tell the plane tree by its queer trunk. The bark peels off in big flakes, and the bright under-

surface shows up clearly, giving the trunk an odd, patchy appearance. Children in the towns will know this tree very well, for it is a favourite one for town-planting.

Its leaves are rather like those of the sycamore, being hand-shaped with five fingers. If you pull one off with its stalk you will see that the base of the stem neatly covers next year's bud. The fruit you will know very well—it hangs down like a lot of little round balls among the branches.

The Elder

Country children are sure to know this tree, for it is from the elder's stems that they so often make pop-guns or pea-shooters. The stems are filled with pith, which is easily taken out, leaving a neat, hollow tube. The elder never grows very tall, and in summer time its flat-topped clusters of creamy flowers are very noticeable.

THINGS TO DO

1. Start out with a sheet of paper or a notebook in which you have roughly drawn the leaves of the trees you want to find.
2. Bring back leaves of the trees, together with notes of anything special you have noticed about the trees.
3. Draw and colour the leaves. Put the names underneath.
4. Look up in your reference book the trees whose leaves you find and read what the book says about the tree.
5. When you feel you are really getting to know something about trees, make a Tree-Book for your drawings and notes.

CHAPTER 10

SEASIDE CREATURES

SOME of you may be going to the seaside for your holidays, so in this chapter I am going to tell you what to look for on the beach and in the pools. You will find it great fun to hunt for these creatures and look at them closely.

I am sure you will want to go shrimping or prawning. Look into the rock-pools. Do you see those grey-green shadows darting here and there? They are shrimps. Some of you will be surprised that they are not pink like the shrimps in the shops—but those are boiled, and the boiling turns them a different colour. The prawns in the deeper pools look like very big shrimps. Catch some and look at them. If you want to examine them very carefully you can buy a few shrimps or prawns from the fishmonger.

They look as if they were wearing suits of old-fashioned armour, don't they! They have many enemies, and so they must protect themselves. Sometimes their suits of armour get too small for their growing bodies, and then the shrimps and prawns split them and squeeze out of them, showing brand-new suits underneath. These are rather soft, however,

so, fearful of being eaten, the creatures hide away until their new armour has become as hard as the old.

Look at their legs. They have two different sets, one for walking and one for swimming! How queer it would be if *we* had two sets of legs, wouldn't it! The swimming legs are near the tail, and are fringed and flattened. The walking legs are near the head, and are long and thin. Look at the creature's eyes. They are set on a short stalk, so that it may see as much as possible. Now feel the spike that juts out from the head. If it is saw-edged, you are holding a prawn. If it is smooth, you have a shrimp. Now you will be able to tell the difference between a small prawn and a big shrimp!

You all know crabs, I am sure. You have seen them scuttle sideways over the sand when frightened, or bury themselves swiftly in the bed of a rock-pool. Watch them when you can, and if you catch one, turn it upside down and have a look at the queer little creature.

If you buy a crab from a fishmonger's you will easily be able to see its walking legs, its funny, turned-back tail, its broad, armour-like shell, its strong pincers and its queer eyes. Look at it carefully. Count its legs (five pairs). They are strong, well-developed legs, used for walking, for the crab walks far more than it swims. Has it any swimming legs? Look and see.

THINGS TO LOOK FOR ON THE SEASHORE

1. The crab. 2. The hermit crab: it has tucked its soft tail in an empty whelk-shell. 3. Prawn. 4. Shrimp. 5. Starfish. 6. Jelly-fish. 7, 8. Anemone, open and closed. 9. Egg-case of skate. 10. Egg-case of dogfish. 11. Egg-case of whelk.

It has—but they are hidden under the turned-back tail! They are almost useless, for the crab rarely swims.

The crab changes its suit of armour regularly, and immediately afterwards it hides away in safety, for its new shell is soft and needs to harden. Once it is hard the crab comes out boldly, ready to face its enemies once more.

There is one crab, the hermit-crab, whose tail-part is long and soft, so that he is always afraid of having it eaten by some hungry creature. He knows that he must find somewhere to tuck away his tail in safety. So he hunts about until he finds an empty whelk-shell, and into this he tucks his soft tail, holding firmly to the inside of the shell by means of pincers. He looks a queer sight when he is at home in the shell! His legs hang out of the opening, but the rest of him is safely inside the shell! When he wants to move about he sticks out his head and walks with his front legs, dragging the whelk-shell behind him!

Do you know the strange starfish, with its five fingers? You may have found it lying stranded on the beach, waiting for the tide to come back and cover it; or you may have seen it gliding along in a rock-pool. How does it walk? Turn it upside down and we shall see. Each of the five rays, or fingers, is grooved underneath and carries four rows of sucker-like feet. It clings to the rock with some of its feet and draws

A STARFISH

The underside of a starfish, showing the mouth right in the centre and the hundreds of tube-feet on each ray or arm. By means of these tube-feet the starfish is able to walk.

the rest of its body up to them. Then it takes hold of another piece of the rock a little farther on, and draws its body forward again.

Has it a head? No, it hasn't. How strange! It has really only five fingers, a mouth and stomach. Its mouth is underneath, in the middle of the rays, and its stomach is just behind it. Run your fingers along the upper surface of the rays. How rough and spiny

they are! That is to prevent enemies from making a meal of the starfish. Among the spines are many tiny pairs of pincers, continually snapping to prevent anything from settling on the starfish. They are so tiny that you cannot see them easily with your eye alone.

If a starfish meets with an accident, and loses one or more of its rays, it does not mind. It simply grows new rays—and the ray that is cut off may even grow four more fingers and become a new starfish!

Another strange creature is the queer jelly-fish. Have you ever seen them swimming in the sea, opening and shutting their big jelly-umbrellas as they go along? Perhaps you have found some lying on the sand. They are shapeless masses of jelly then, not the graceful things they appear in the sea. As they are made up of water and very little else, the hot sun soon melts them, and in a short time nothing is left of the curious creatures but a little round mark on the sand.

They get their food in a queer way. All round the edge of the jelly "umbrella" is a fringe of fine threads, the creature's fishing-lines. These threads are set with poisoned darts, and if any unwary shrimp or other creature swims against them, the darts shoot into the victim's body and poison him swiftly. Then he becomes a fine feast for the jelly-fish.

There is one jelly-fish we must beware of when we bathe in the sea. It is a yellow-brown colour, and its

name is the Stinging Jelly-fish. Its threads are so poisonous that they may make us ill if we brush against them. We feel as if we have been stung by a nettle!

In the rock-pools you must look for the sea-anemones. They are given that name because they look rather like flowers when they put out their fringe of feelers—but really they are more like dahlias than anemones. When their feelers are not to be seen they look just like lumps of red-currant jelly. They cling to the rocks, and when they are hungry they fling out a circle of petal-like feelers round the top of their body, and wait for food.

These feelers sting any creature that comes too near, and then close over the victim, pushing him into the mouth that is in the centre of the feelers. The anemone feeds on the soft parts of the creature's body, and throws out the hard parts afterwards.

You do not need to be afraid of touching the sea-anemone, for it can only hurt tiny creatures. Feel it. It is just like a solid knob of jelly. When it wants to close up it squirts the water out of its body and folds its circle of feelers neatly inside.

There are three curious egg-cases I hope you will look for on the beach. You will be likely to find them after a storm, somewhere at high-water mark, among all the rubbish flung up by the sea.

The first is the egg-case of the skate. It is a big

black case, oblong in shape, horned at each of the four corners. This case contained the egg of the skate fish.

The second is the egg-case of the dog-fish. It is very like the case of the skate, but has black tendrils at each corner, instead of horns. See if you can find the slit in the case, showing where the baby fish made its escape into the sea.

The third thing is the funny papery ball made up of many small cells in which were once the eggs of the whelk. It is quite a big ball, and you can squeeze it as you do your sponge. Tear the ball to pieces and see the little rooms where the baby whelks grew.

I have no space to tell you of the shell-creatures you should look for—the cockles, the mussels, the limpets, the periwinkles and others. Hunt among the rocks and see how many you can find. You will discover many interesting things in your search.

THINGS TO DO

1. Look for all the things described, when you next go to the sea. If you think you are not going, you can easily look at shrimps, prawns, crabs, lobsters, whelks, scallops, winkles and so on in your fishmonger's shop.
2. Draw a shrimp or a prawn. Put underneath why it has two sets of legs.
3. Collect as many different sorts of shells as you can, and try to find out their names.
4. Collect such things as egg-cases of whelk, dogfish, skate, as well as shells. Draw them.
5. Write down what you know about one of these three things—the jelly-fish; the starfish; the hermit-crab.

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Dear Boys and Girls,

I wish you could come with me and walk over the hills, through the fields, and down by the river, finding a hundred exciting or beautiful things by the way. I should like to take you fishing in the ponds, and fill your jars with snails and tadpoles. I should like to help you to make a fine bird-table, or to prepare a splendid aquarium. I should like to give you a garden of your own, and show you how to make it a place of bright colours and sweet scents.

But I cannot do all these things—so instead I have written these four books for you, so that you may read them and do for yourselves all the things I would like to do with you. We will go round the year together, and you must discover with your teacher and your friends all the exciting things there are to be found in Nature study.

Good luck to you in all your Nature work, and may you find as much delight in using these books as I found when writing them for you!

Enid Blyton

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CHAPTER I

IN OUR CORNFIELDS

TO-DAY I am going to tell you about our cornfields and the different grains we grow there. Even town children know corn when they see it, for little sheaves of it are always brought to decorate our churches at harvest-festival time. Country children know it well, because their fathers have to do with its sowing and reaping.

Why is corn so important to us? It is because we get from it the flour to make our bread and our porridge; it is our chief food. We ought to know something about it, and we ought to be able to tell the different corns from one another.

Our cornfields are very lovely when the corn is ripe. It is a rich gold colour and waves beautifully in the wind, making a whispery, rustling noise. Red poppies peep here and there, corn cockles shake out their pink petals, and the scarlet pimpernels glow as if they were on fire, set close to the dry ground. These flowers are weeds—it is the golden corn that is the farmer's joy.

Look at it. What does it remind you of? It is very like a giant grass, isn't it? It has long narrow

leaves like grass, a jointed stem, and the spike of corn at the top reminds us of flowering grasses. Corn is simply a cultivated grass. Just as we have little wild strawberries and big garden strawberries, small wild poppies and big cultivated ones, so we have wild grasses in the hedges and big cultivated grass in our fields—the wheat, barley and oats we see growing in the country.

Our fields of corn are small compared with those in America or Canada. There you may see corn stretching right away to the skyline, waving in the hot sun—miles on miles of corn, so much that you might say, " But who will eat all that ! "

We cannot grow enough corn in our own country to feed our people, so other parts of the world grow it for us. Is there a map in your atlas showing the corn-lands of the world? Look and see. If there is, you will be astonished to find what a great deal of the earth is used for growing corn.

How many different corns do you know the names of? Wheat is one. Barley is another, and oats. Then there is rye, too, but it is not grown in our country so much as the others. There is yet another corn called maize, or Indian corn. In Longfellow's " Hiawatha " poem you will find a fine story telling how the gift of maize came to the Red Indians. You will like to read it.

We call all our corns cereals. The name cereals

A CLEVER MACHINE THAT CUTS DOWN THE CORN AND BINDS IT INTO SHEAVES FOR THE FARMER

comes from Ceres, who was the goddess of farmers and who loved to look after the crops and fruits of mankind. Do you eat cereals for your breakfast? If you have grape-nuts, shredded wheat, post-toasties or any of those kinds of foods, you have cereals. They are all made from corn.

The corn you perhaps know the best of all is the wheat. Have you an ear of wheat there? An ear is simply a stalk of corn with all its grains. Look at your ear of wheat. Do you see the yellow grains packed closely together on the stalk, each with a spiky tip? They are the seeds of the corn. Pull some off

and look at them. If you had seen this ear in June, when it was green and unripe, you would have seen big stamens hanging out, with large anthers (the tops of the stamens, where the pollen is kept) swinging in the wind, and you would have seen feathery stigmas, too, all ready to catch the powdery pollen.

Wheat does not only give us the flour for our bread. It gives us the macaroni we sometimes have in our milk puddings. Do you have puddings of semolina at home? That is made from wheat, too, and so is the vermicelli you may have tasted in puddings as well. Shredded wheat comes from wheat, of course, and so do puffed wheat and the funny brown grape-nuts some of us like so much for breakfast. What a lot of different dishes we make from our ears of wheat!

Here is a very bristly, bearded ear of corn. It is barley. You may have picked wild barley grass in the meadows and have played a sly joke on your companion by pushing the bristly head up his sleeve. When he tried to get it down, the bristles stuck tight into his sleeve, and unless he managed to turn it right round he could not pull it out, but had to leave it there, bristling uncomfortably!

The grains are very neatly and tidily packed together and the bristles are long. We can easily tell barley from wheat because of its long beard. What is barley used for? You are sure to have seen the packets of

barley that mother takes down from the shelf when she wants to put barley into the soup or into a stew. They are hard little grains, but when we see them in the soup they have swelled up and are big and soft.

Left to right: WHEAT, BARLEY, RYE, OATS and MAIZE (a head of maize is really much bigger than the other corns shown)

In some places the barley is made into bread. Most of the barley, however, goes to the breweries and is made into malt, which is used for brewing beer. A good deal of it goes also to the distilleries and helps to make whisky.

Have you any rye to look at? We do not grow it very much in our country. It grows well in colder countries and does not mind poor soil. It is very like barley, isn't it? What is the difference? The bristles are not so long and the grains are not so neatly packed up the stalk. Bread is made from rye and we call it black-

bread, because it is very dark in colour. Look for wild rye-grass in the meadows. There is sure to be plenty there.

Do you know the pretty, feathery oats? Scottish children will know oats very well indeed, for it likes the colder climate of Scotland. Do you have porridge for breakfast in the winter? If you do, you are eating oats, for porridge is made from oats.

Oats are made into bread, too, and into biscuits and cakes. Have you had oatmeal biscuits? There is a very useful animal who likes oats as much as we do —and that is the horse! Look at him putting his nose into his bag of oats—how he enjoys it!

Perhaps some of you grew grains of maize when you tried germination experiments in the spring-time. Do you remember the queer-shaped little golden grains? If we keep hens or pigeons we know what maize is like, too, for we give it to the birds to eat. Sometimes we have it in a pudding, for cornflour comes from maize. Has anyone seen it growing?

It is grown a great deal in America, and there it is the chief cereal. It does not look very much like corn when it grows. It shoots up very tall, taller than a man, and has stems rather like bamboo, with large, broad leaves hanging down from the joints. At the top is a thick spike, and inside it are hundreds of maize grains, packed as tightly as can be, ripe and yellow.

Ask your greengrocer to show you a head of maize if he has one.

The corn does not have flowers such as the buttercups, poppies or dandelions have. When it is in flower in June or July we see no brightly coloured petals glowing in the sun. There *are* no petals to see—only stamens and stigmas, shaking loosely in the wind. It is the wind that takes the pollen from the stamens and blows it on to the waiting stigmas; so there is no need for the corn to waste time and energy on pretty petals or sweet scents, for the wind has neither eyes nor nose. Those flowers that need the help of bees, beetles, flies or moths provide colour and scent, for these insects are attracted by brightness and sweetness. The corn merely hangs out its stamens for the wind to shake when it goes by, and hopes that some of the pollen will fly to the feathery stigmas; and, of course, it does, so that the ears of corn ripen into good grain and give us the food we need.

Men reap the corn and it is taken to the mills to be ground. The husks are separated from the grain and are used as bran, which cattle like to eat. The stalks of the corn become dry straw, and we use it for many things—thatch for cottages, bedding for cattle and for dogs in kennels, and we also put it under our strawberries to keep them from being spoilt by mud, when it rains. Can you think of some other uses?

Go out into the meadows and look at the wild grasses. How many different kinds can you bring back with you? Do we use these grasses as we do wheat, barley and oats? No—but the farmer finds them very useful in another way. He grows them as grass for his cattle, and as hay for the winter-time. Have you seen hay-meadows! Aren't they lovely, scattered with golden buttercups and white moon-daisies with the red sorrel sticking up here and there? The hay is cut, dried and built into stacks, and the cattle are glad of it when the long winter is here and there is little fresh grass to eat.

See if you can find wild barley, rye-grass and wild oats. Bring back as many other grasses as you can, and try to find out their names. Look for the loose stamens and shake out the pollen. You will be surprised to find what a lot of different grasses grow under your nose, never noticed by you before!

THINGS TO DO

1. Go to see a cornfield if you can. Listen to it whispering.
2. Draw an ear of corn. Pull out a single grain and draw that.
3. Read the story of Mondamin in the Song of Hiawatha.
4. Write down three sorts of corn you know, and say what they give us to eat.
5. Draw three wild grasses. Find out their names and write them underneath.

CHAPTER 2

THE BIRDS FLY SOUTH

DO you remember how we listened for the cuckoo's pretty double-note in the spring-time? We wanted him to come back because his call told us that spring was really here! We listened to his "Cuckoo! Cuckoo!" in May, we heard him change his tune in June—and then, what happened? We heard him no more!

Where had he gone? And why had he gone? The screeching swifts disappeared too, not long after—and now, one by one, other birds are going away from us or have already gone. The willow-warblers, the nightingales, the sand-martins have all said good-bye, and soon the swallows and house-martins will fly away too, and one morning we shall listen in vain for their musical twittering. We shall see them no more until next spring.

They all fly southward in the autumn to the warm lands where the sun shines brightly and insects are easily found. Get out your maps and see where they go to. Find the Mediterranean Sea, Egypt and Algiers. Look for Cape Town at the very south of Africa. "Surely no bird can fly from England all the way to

Cape Town!" someone says in surprise. It is certainly astonishing, but quite true.

It has been proved that a swallow from Northumberland flew all the thousands of miles to Cape Town—and even longer flights have been recorded. Another very long flight, which you can trace on your maps, is that of the Virginian Plover, which flies each year all the way from Labrador to Brazil.

In the spring-time our birds fly back to us, and arrive on our shores eager to nest and bring up their young ones. Where they were born themselves is "home" to them, and so great is their instinct for "homing" that a bird will actually fly back to the same village, and find the same tree or barn, where it had its nest the year before! There it will build, and bring up its young ones, and they, in their turn, will perhaps come back the following year and nest in the same village in which they themselves were born.

Not all birds leave us in the autumn. You will be able to think of many that stay with us all the year round. We call these birds Residents, because they reside or live with us. Let us think of some. Sparrows, starlings, rooks, robins, thrushes, blackbirds, tits—we can see these in the winter as well as in the summer. But even these resident birds sometimes travel about to look for better feeding-grounds; the thrushes we have with us in the winter may not be the same ones

SWALLOWS GATHERING ON TELEGRAPH WIRES BEFORE MIGRATING

we had in the summer. They may be thrushes from a more northerly part of the country who have come south because of a cold spell.

And now you will be asking a few questions, some of which I shall not know how to answer. Why do the birds go south? Why do they come north in the springtime? How do they find their way from one country to another? What began their great movement twice yearly? Well, before I try to answer, talk about it yourselves, and see what ideas you have.

How will you answer the question, "Why do the birds fly south?" I think I know. "Because," you say, "the days are getting cold and food is getting short." Well, that is correct for, say, the swallows, who leave in October—but what about the swifts and the parent cuckoos, who leave in July, when the weather is hot and insects everywhere?

Why do the birds come north in the spring? I am sure you will say it is because they want to nest in the place where they themselves were born. But why should they not stay to nest in the warm, plenteous region where they live in the winter-time? Why must they go to and fro like this, and seek a summer nesting-place and a winter resting-place? They do not nest in the south—they always come north to breed.

It is a general rule for all birds in our part of the world to nest in the coldest part of their range, and it

is a good rule, for the youngsters are hardier and sturdier then. The birds, however, cannot actually *know* that—something must have happened at a distant time to start the strange habit of world-wide migration. What could it have been?

Well, we do not really know. Some naturalists say that long ago, when the world passed through a very cold age and glaciers spread down from the north, accompanied by bitter winds, all life was driven southwards. The birds migrated easily, because their wings could take them anywhere, and they flew off to the south to seek the warmth and food they needed. Then, when summer came and the sun melted the glaciers, the birds returned as far northwards as they could, striving to nest where they had nested before, only to be driven south again as winter approached. So, say some naturalists, began the great to-and-fro movement of the birds. The habit was started, became an instinct, and, because it proved good for the race of birds, continues down to this day.

This may be all wrong—but, at any rate, we feel sure that at some time or other in the history of birds some great happening began the habit of migration. It is an excellent custom, from the bird point of view, because to come north in the spring-time means warm weather, plenty of food (when the heat in the south may mean parched lands and food scarcity), long hours of

daylight in which to look for food for the youngsters, and a hardy upbringing. To go south in the autumn solves the problem of warmth and food at that season.

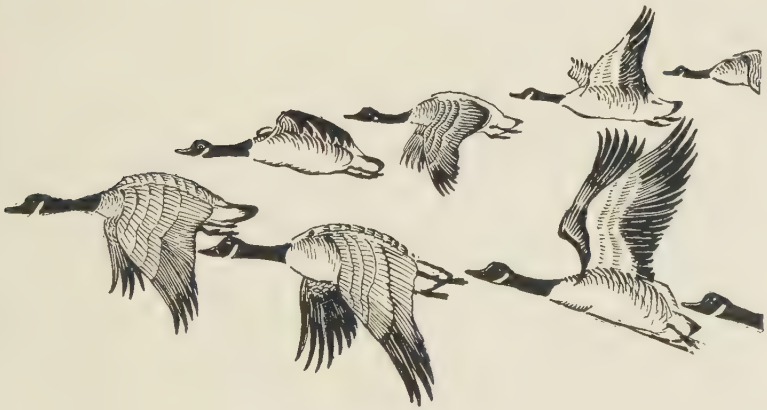
How do the birds find their way? "Oh," you will perhaps say, "that's easy. The old ones lead the way, of course! They remember it from the last year!"

But the strange thing is that the old ones do *not* lead the way! Except in a few cases, old and young fly away separately. The young ones fly first, and as they have never before left our shores, how in the world do they find their way? The older ones follow later, except the cuckoos, who leave *before* their young.

Much of the flying is done at night, when no landmarks can be seen, and a great deal of it is over the sea. Some birds fly close to the water, so that, even if they wished to, they could not see their way clearly! How, then, do they know their way half across the world?

We do not know. Birds have a great sense of direction, excellent eyesight, and a wonderful memory for landmarks, but these things cannot alone account for the wonders of migration. The wind helps a good deal, because, in the springtime a south-west breeze blows, and in the autumn a north-east wind. Birds starting out on their long journey fly straight upwards until they reach a strong current in the upper atmosphere, and then fly steadily onwards.

It is a brave, venturesome thing, this long flight to far countries. The weather may be good at the start, but storms, fogs, gales, head winds, blizzards may arise, and then the flocks of tiny travellers are in a dreadful plight. If they are over the sea thousands



WILD GEESE MIGRATING: THEY FLY IN ARROW-HEAD FORMATION

fall and are drowned. If a ship or steamer is near, the captain suddenly discovers that hosts of little birds have flown to it and are resting in every corner!

A lighthouse, with its great white beam of light, attracts hundreds of thousands of weary birds in a storm, and they dash themselves to death against the lantern, or fall dazzled into the sea. Many lighthouses have perches round them for the birds, but there

is never enough room for the multitudes that seek sanctuary from the storm.

A great many migrants follow the coast-line when flying, or travel down river-valleys. We know this because such flocks have been seen. Other flocks fly so high that we cannot see them with our naked eye, but must use a telescope. We may perhaps hear their call, but to our eye the sky is quite empty! Many birds fly at night, and these have been seen by astronomers who, looking at the moon through their telescopes, suddenly see great flocks of birds in the night-sky, clearly defined against the bright moon. The birds fly about 30 miles an hour, but may speed up to 60 if they are trying to out-fly a storm.

A great many birds are ringed by naturalists when they are young, and it is these marked birds that tell us such a lot about migration. A ringed bird has a light band or ring round one of its legs, and on the ring is an address and a number. Anyone finding a ringed bird should write to the address, and give the number of the bird, and the place and date it was found. We know then how far the bird has travelled. Set the bird free again, of course, so that it may give yet more information if it is caught a second time. I have never found a ringed bird yet, but I am always hoping to.

The swallows will soon be gone this year. Have you seen them collecting yet? Near my house there

is an old barn and also some telegraph wires, and the swallows crowd together in hundreds on the roof and on the wires before they go. Then one evening they rise in the air and fly southwards, and the next morning I cannot see a single one. They have all gone, and I shall see them no more until the next spring-time. Keep your eyes open if you still have swallows about, and watch to see if they collect together in your district —and be sure to notice if young and old are together. The young have shorter tails than the old ones and can easily be picked out.

Famous naturalists say that if only people would notice the birds as carefully as they notice the weather, we should soon solve many of the mysteries of migration, so let us make a start this week, thousands of us all over the kingdom, and perhaps we shall, between us, find out something really worth knowing !

THINGS TO DO

1. Make out a list of all the birds you are sure you will see in the winter.
2. Look every morning for the swallows. Put down on the Nature-calendar, or in your Nature notebook, the date of the last day you see them.
3. Draw a lighthouse with many birds flying round it.
4. Have you any resident bird in your garden with peculiar markings, such as a blackbird with a white feather or two? If you have, watch for it all the year round, and see if it stays with you.
5. We have winter visitors as well as summer visitors. The fieldfares are winter visitors. Where do they come from, the north or the south?

CHAPTER 3

ALL ABOUT SHADOWS

YOU know something about shadows already, because we have spoken of them in another lesson. Look out of the window. Is the sun shining? Can you see any shadows? Is the sun behind a cloud? If so, the whole school is in that cloud's shadow, isn't it, and will stay there until the cloud moves away from the face of the sun.

How are shadows made? Think for a minute and then try to say in a few words what a shadow really is. It is more difficult than you thought it would be, isn't it? I expect somebody has managed to put it into a few words, such as the following sentence: A shadow is a dark patch caused by something blocking out the light of the sun, of a lamp, or of a candle.

Whenever we put something near a light, that object makes a shadow behind it. The light cannot shine right through it, and so there must be a dark patch behind the object where the light cannot shine. That dark patch is the shadow. Hold out your hand the next time the sun shines in at your class-room window. Look down at your desk. Do you see the shadow of your hand? You have blocked out a little

of the sunlight, so that somewhere behind your hand is a dark patch, the shadow of your hand. A shadow is simply a place the full light does not reach.

If the sun is shining, we will go out into the playground for a minute. Stand so that the sun shines into your face. Where are your shadows? Yes, they are all behind you. Nobody has one in front of him. Why not?

Now turn round with your backs to the sun. Where are your shadows now? They are in front of you. They did not move round to the back when you turned. Why not? Because shadows must hide from the light, and whether you turn towards your shadow or away from it, it must always be on the side opposite the light.

Do you remember the shadow game (in the Summer Book)? If you played this you found that in the mornings and evenings your shadows were long, and at noon they were short. Does anyone know why that should be?

Someone is sure to know that in the early morning and in the evening the sun is low in the sky, so our shadows are long. At midday the sun is high, so our shadows are short. But why should the height of the sun make such a difference to the length of our shadows?

Let us go indoors again and find out the reason. We shall want a candle or a lamp to be the sun.

Now here is our candle, alight. But it does not

shine very brightly in the light classroom, so we will draw down all the blinds. Now that the room is dark our candle seems to shine much more brightly.

Stand in a ring round the candle. Where are our shadows? All neatly behind us! Now one of you must come out and stand where everyone can see him.

Someone must hold the candle level with his waist, but some distance away. Do you see his shadow on the floor? What happens to the shadow when the candle is raised on a level with his head? Yes, it has grown shorter, hasn't it?

Now hold the candle very low—what an enormously long shadow creeps behind the boy! Now hold the candle very high, and his shadow seems to run right up to him, so that it is short and squat. Hold the candle right over his head—now where is his shadow? He doesn't seem to have one!

Now do you see why our shadows are long in the mornings and evenings and short at midday? You have seen the sun low in the sky in the early mornings when you get up, haven't you? It is like a candle held at this level, low down, so that our bodies cast long shadows behind us. As it climbs the sky, it gets higher, and so our shadows become shorter. Then in the evenings the sun sinks low again, in the opposite sky, and our shadows lengthen out.

Does the sun climb so high that it is exactly over

A SUN-DIAL IN AN OLD GARDEN

our heads? If it does, we shall find that at mid-day we have no shadows, and everything is a terrible glare. But fortunately for us the sun does not shine from immediately overhead, and so we always have a shadow, either short or long according to the time of day. In tropical countries the sun climbs so high that it is right overhead, and the people in those lands do not dare to walk out when they have no shadows, for the sun is so terribly hot. It beats straight down, and its rays then are fierce and scorching.

The higher the sun climbs the hotter the weather. That is why our summer-time is hot—the sun climbs higher then than in the winter. Shall we have longer or shorter shadows in the summer? Yes, shorter, of course, because the sun is higher up. You remember that the higher we held the candle, the shorter our shadows became. Shall we raise and lower the candle again, and watch the shadow grow short and long, short and long? That is just what the sun does to our shadows as it rises in the sky, climbs high and sets again.

Now I should like you all to keep a Shadow Chart to be filled in on a certain day each month, making twelve entries in a year. One of you must also make a big chart to be put on the classroom wall. You will want twelve squares ruled on your chart, one for each month. Your classroom chart may either be one very large sheet of paper with twelve squares ruled on it, or may be twelve small pieces of paper pinned side by side, each to be filled in as the months pass. You only need to have on the wall those sheets you have filled in, but at the end of the year you will have all the twelve, of course.

If you prefer, you may have the same for your own small charts—twelve pages with a chart on each, instead of one large page with all the charts on. Perhaps you would like to make a small book of twelve

pages, with a design of sun and shadow on the front, and name it "My Shadow Book."

Now for your Shadow Charts you must do exactly the same each month. It is really the Shadow Game drawn in your books! Go out into the playground. Choose a spot which you know is ALWAYS in the sun when it shines. Mark it in some way so that you will be able to use the same spot each month.

Now on the same day each month you must do the same thing—you must get a boy or girl to stand on that spot at, say, half-past nine in the morning, at noon, at two o'clock, and at half-past four. One of you must have a notebook, and another must have a measuring tape. Measure the length of the shadow cast, and call out the measurement to the boy or girl with the notebook so that he or she may note it down quickly. If you want to be very exact, make a mark where the tip of the shadow is, and then measure from that tip to the tip of the next shadow when you measure the length again later on in the day.

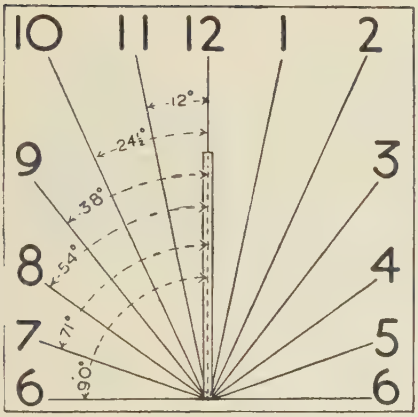
The next day you can draw the shadow lengths in your books or on your charts. Put arrows to show which way the sun goes, and also put the name of the month and the date. You can make the diagram to scale, using an inch for every foot.

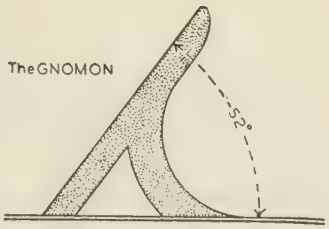
Do this every month and compare the charts with one another. You will see very clearly the difference

between morning, noon and evening shadows, and between the shadows cast in winter and in summer. When the charts are all completed, look through them and write neatly at the end what you notice about them and what is the reason for their differences.

How many of you have seen a sun-dial? Not very many, I expect, for people do not need them now, in these days of watches, clocks and wireless signals. Sun-dials were the clocks of two or three centuries ago. They were shadow-clocks. A sun-dial was usually a brass plate on which were marked the hours of the daytime (not of the night). Fixed to the brass face was an upright piece of iron, pointing to the north, sloping downwards. When the sun shone the pointer cast a sharp shadow, and this pointed to the hour of the day. At ten o'clock, for instance, the shadow lay on the figure 10, at two o'clock it pointed to 2. It was thus a kind of shadow-clock, not very correct always and not reliable, because it was only useful on sunny days. In the night it was of no use at all.

Perhaps one of you can make a rough sun-dial just to see how it works. It will not tell you the correct time, because there are various things you must do of which I have not time to tell you here. You can easily make a very rough one by putting a piece of cardboard in the sun, with a pointer fixed to it, and marking the place each hour where the shadow is.





The above dimensions show how a sun-dial accurate enough for any place in the British Isles can be constructed. Place the 12 line exactly north and south. The sun-dial, of course, does not show Greenwich Mean Time; even at Greenwich it may vary by 16 minutes (without allowing for "summer time"). In addition it would be 4 minutes slow for every degree west of Greenwich.

HOW TO MAKE A SUN-DIAL

Shadows are often very beautiful. Perhaps you did not think that shadows could be lovely? Ah, but they can! Trees cast purple shadows in the hot noonday sun, deep and glowing. Shadows on the white snow are blue. Shadows of clouds on the sea are deep purple. Moonlight shadows are black and mysterious. Look into shadowy depths, look at shadow and sunlight side by side, and see how lovely shadows can be.

THINGS TO DO

1. Make a Shadow Chart or Book and keep it each month.
2. Write down why a sun-dial is of no use on a rainy day.
3. It is interesting to examine the shadows cast by glass, especially thick glass prisms.
4. Draw a row of poplar trees standing in the evening sun. Put in their shadows. Draw the same trees in the *noonday* sun, with their shadows.

CHAPTER 4

BULBS FOR THE CLASSROOM

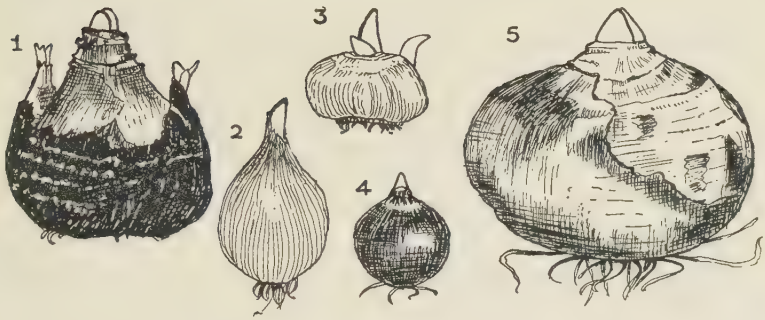
IN this lesson I am going to tell you exactly how to plant bulbs and grow them in the classroom. We have all tried to grow bulbs, I expect—but not so very many of us have been gloriously and completely successful. This year we will all grow magnificent flowers, the pride of our classrooms, and the admiration of all the passers-by.

There are four ways in which we can grow our bulbs and corms. (A bulb, such as a daffodil, shows layers of fleshy scales when cut through, but a corm—that of a crocus, for instance—is quite solid.)

1. We can grow them in pots of earth.
2. In bowls of fibre.
3. In special glasses or vases, in water.
4. In bowls of stones and water.

I will take each method in turn, and when you have heard them all, you can talk about them and decide what you would like to do.

Our daffodils will grow splendidly in pots of ordinary soil. If you each want a daffodil to yourself, small pots will do, but better results are obtained if you get bigger ones and plant five or six bulbs in them.



SOME BULBS YOU CAN GROW

1. Daffodil. 2. Tulip. 3. Crocus corm.
4. Scylla. 5. Hyacinth.

If the pots are old ones, you must scrub them well, inside and out. If they are new ones you must put them into water and let them soak for twenty-four hours. Then dry them before using. Get two or three pieces of broken pot and place over the hole at the bottom of the pot. If you don't do this you will find that every time you water the plant, soil will run out of the hole with the water, and soon you will see your plant sinking lower and lower !

Now half-fill the pot with soil (which must be the best you can bring—not too clayey, not too sandy, but good black loam). Put your bulbs on the soil, quite close to one another, but not touching. Fill up your pot to within an inch of the surface, press down well, and then water thoroughly.

Next you can do one of two things. You can either put your pots out of doors in a bed of cold ashes (*not* new ashes, please) which is called a plunge-bed, and leave them there to make good root-growth; or you can put them away in a dark, cool, airy place—a cupboard, for instance.

Water them once a week, but do not let them get too wet. When the green noses of the bulbs are just over an inch high, bring them out into the light. Do not put them into the strong light at once. Put them into the darkest corner first, and bring them nearer and nearer the window. After a week or so they will enjoy any sunshine there is. Give your pots a little twist each day, or else you will find that the leaves all grow towards the light, and your plant will have an ugly, lop-sided look.

Water your plant when it needs it. You will know when to water it by feeling the earth at the top of the pot. If it feels moist and cool, no water is needed. If you think your plant is not doing as well as it should you can give it a little soot-water every few days.

The favourite way of growing bulbs is in bowls of fibre. How many of you have seen and handled bulb fibre? Perhaps you have some in class now. Feel it. Smell it. Isn't it good! What is it made of? You will find bits of shell, sand, charcoal and peat fibre in it—and it is useful for growing bulbs in bowls because we can

plant them without bothering about a hole for drainage. The charcoal in it will keep our bowls sweet.

You can buy cheap bowls, or you can bring one or two from home that can be spared. Now you must prepare the fibre for use, and I know you will love to do that. It comes from the shop in a dry, powdery state, and we must make it wet—which is not so easy as you might think, because every part must be equally moist.

You have all seen how your mothers stir milk into a cake mixture; we mix our water into the fibre just as if *we* were making a cake or pudding. Put it into a big enamel bowl and make a hole in the centre of it. Then stir round and round, and you will find that your fibre gradually becomes moist all over. Pour in more water as needed. The fibre must not be so wet that water can be squeezed out of it.

Now pack your bowls half full of damp fibre, and place your bulbs on it. Fill up with fibre to within an inch of the top to allow for future watering. Press down the fibre firmly. Then put away in a dark, airy place. Bring out when the shoots are just over an inch high, and water when needed.

The fibre should keep sweet and fresh, but sometimes it becomes mildewy because of too much watering, or too little air. It is difficult to tell when we have given enough water to bulbs grown in fibre, and as the water that is not taken up by the fibre collects in a puddle at

the bottom, we must find some way of preventing over-watering. This is very simple. An hour after watering your bulbs, go to them again and tip them up carefully. Any surplus water will have collected at the bottom by then and will run out at the tipped side of your bowl. Don't forget to do this, as it may mean all the difference between healthy flowers and weakly ones.

Hyacinths or crocuses may be grown in tall vases or glasses specially made for the purpose. Acorn-glasses may be used for crocus corms, so if you have any at school, use those.

The beauty of growing bulbs in water is that you can see the whole growth from beginning to end. There is a place at the top of the glass to put the bulb, and you must choose your biggest bulbs or else they will slip down the glass. Rest them on the curve of the neck, and do not let the bottom of the bulb touch the water. Put in a piece of charcoal, and then you will not need to change the water at all. All you will have to do is to fill up the glass occasionally when the water-level drops. You will be able to see the roots shooting from the bulb-base, and you can watch them growing longer and longer until they touch the bottom, and entirely fill the glass! The green shoot will appear at the top of the bulb, and soon it will open sufficiently for you to see the close-packed flower inside. What an exciting time that is! Then gradually the leaves

A LOVELY BOWL OF HYACINTHS GROWN INDOORS

grow longer, and the flower forces its way up, becoming coloured as it does so. And at last your hyacinth is out in all its beauty.

You need not put away in the dark any bulbs or corms grown in water, as they will grow quite well in the light from the very beginning. Do not put them on the window-sill at first, but keep them on the darker side of the room. The flowers will be larger if you *do* put them away with the bowls and pots for a few weeks, so perhaps you would like to keep some out to see them growing and put away others for stronger growth.

You can grow crocuses in fibre or in soil—but I have always found that mine grew best in stones and water. Get a bowl and wash it. Then find a great many pebbles varying in size from a pea to a large thimble and wash them. Arrange them neatly in your bowl, and when you have about three layers, rest your crocus corms on top of them close together. Now pile on more stones to the top of the bowl. Then take a jug and pour in water until you think the corms are touching it. If you want to make your bowl look pretty, get a few bits of moss, or a few grass seeds, and plant in the crevices of the stones. You will have to take the moss out when it gets dry and soak it in water before putting it back. The grass seeds will grow, and give a touch of green to the bowl before the crocuses leaf. You can also plant grass seeds in your bowls of

fibre, and the bright green grass-blades look very pretty round the growing bulbs.

It is exciting to watch the crocuses put out their white shoots, which soon become tipped with green as the leaves grow out. The shoots press their way between the stones whilst the roots below grow and take firm hold of the pebbles. Do not put the crocuses away in the dark. Stand them on the window-sill from the first. Let them have every bit of sunshine there is.

Weakly, "leggy" plants may be due to too much watering, or too weak light. If tips of flower-buds and leaves go brown, not enough water has been given. When bringing from the cool, dark place in which the bulbs were first put, be careful not to give too much warmth suddenly or too much light. Do not put in a draught or near a fire.

Make sure your "cool, dark place" is airy.

When buying bulbs, buy early, as then you will have the pick of them. It pays to buy a few good bulbs rather than many cheap ones. August is not too early to buy, but September is the usual month. Buy big, strong bulbs that feel *firm* to the touch, not soft. Bulbs are at their cheapest (for garden use) in the New Year.

Your fibre can be used again another year, so save it when you empty out the bowls. After your flowers are over, wait until the leaves turn brown (water weekly till then), and then plant the bulbs in a shady place

in the school garden. They will flower next spring. You cannot use them for bowls again. Mark with a label where you have planted them.

Buy Golden Spur, Emperor or Sir Watkins daffodils. If you like the paper-white many-flowered narcissus, buy Grandiflorus. A very pretty little jonquil with yolk-of-egg coloured flowers is Odorus Campanelle. It has a sweet scent, and flowers early.

Roman Hyacinths flower earliest of all the bulbs, often round about Christmas time if planted in good time. When planting hyacinths, do not mix the colours, but keep all blue, all pink, etc., in the same bowl, as if you plant a pink, a blue and a yellow together, they will come out at different times.

You will find that the Duc Van Thol varieties of tulips are best for your bowls. If you like a pretty pink, try Cottage Maid, or a gay yellow, try Chrysolora.

When buying crocuses, be sure that in a mixture you are given plenty of yellow ones, as often you will get not a single one. It is best to buy the colours separately. Ask for a deep purple, a pure yellow, and a striped white, and plant in separate bowls.

Scyllas, aconites and snowdrops may also be grown in little bowls. Aconites come out very early indeed.

And now I think I have said enough to help you. Talk it all over, see what money you have to spend, and start right away !

CHAPTER 5

SPIDERS AND THEIR WAYS

IN the clear autumn weather, when we go out into our gardens or over the fields in the morning, we may see a wonderful sight. A veil of fairy-like gossamer is spread over the countryside, and as the sun shines out the tiny threads gleam and shine. Where have they come from?

Hundreds of tiny spiders have chosen that morning to seek their fortunes! They want to see the world, they want to find a new home. And this is how they do it; let us watch one setting out on its great adventure.

First it climbs up to the top of a post or mounts to the top of a bush. Then it turns to face the little breeze, and we see that it is sending out four or five gossamer threads. The breeze catches them, and, as they grow longer, pulls strongly on them. The spider holds tight with all its legs to the post until it thinks it has let out enough thread to carry it safely. Then it lets go! Off it swings in the air, carried high by the breeze, which blows the filmy threads along.

If the breeze becomes stronger the spider hauls in some of the thread. If it drops, the spider lets out *more* thread! It knows just what to do. When it

wishes to alight it hauls in its thread gradually and gently drops to earth. When hundreds of little spiders are out ballooning in this way the meadows become criss-crossed with their gossamer and are a beautiful sight to see.

THE GARDEN-SPIDER. DO YOU SEE THE WHITE MARKINGS, RATHER LIKE A CROSS, DOWN ITS BACK?

You have all seen a garden-spider, with the curious whitish cross on its back, and you have all seen its marvellous web. Perhaps some of you have even seen a spider in the act of making its web. If you have, tell the others exactly what you saw.

Do you know how the spider makes its web? Where does it get its strong threads from? If we turn a spider upside down (quite an easy thing to do if you catch one and it pretends to be dead), you will see six little lumps on its body. These are its spinnerets—little bags of gummy fluid which it uses for its web. If we saw these bags under a microscope, which would make them look very large indeed, we should see that they had three or four hundred tiny openings, and out

of these the gummy liquid is squeezed. As soon as it reaches the air it hardens into a strand of thread. The spider can make its thread thin or thick, sticky or not, as it pleases.

By touching a leaf or twig with its spinnerets and squeezing out thread at the same time and then moving away, the spider draws out a strand of fine silk, which becomes longer and longer the further away the spider goes. Now let us watch it make its web.

First it makes the foundation lines from twig to leaf and leaf to twig—the framework of its web. Then it goes to the middle of the top thread and drops a line from there to the bottom. Then it secures this to the bottom thread and climbs half-way up it to the middle. It begins to make the "spokes" of the web. When these are all finished it goes to the middle and begins to weave a rough spiral thread round and round and round until the outside of the web is reached. Then it makes the *real* spiral, working carefully from the outside to the middle, eating up the first spiral thread as it goes! On this second spiral are tiny drops of gum which entrap unwary flies and hold them fast as soon as they brush against the web. No other part of the web is sticky.

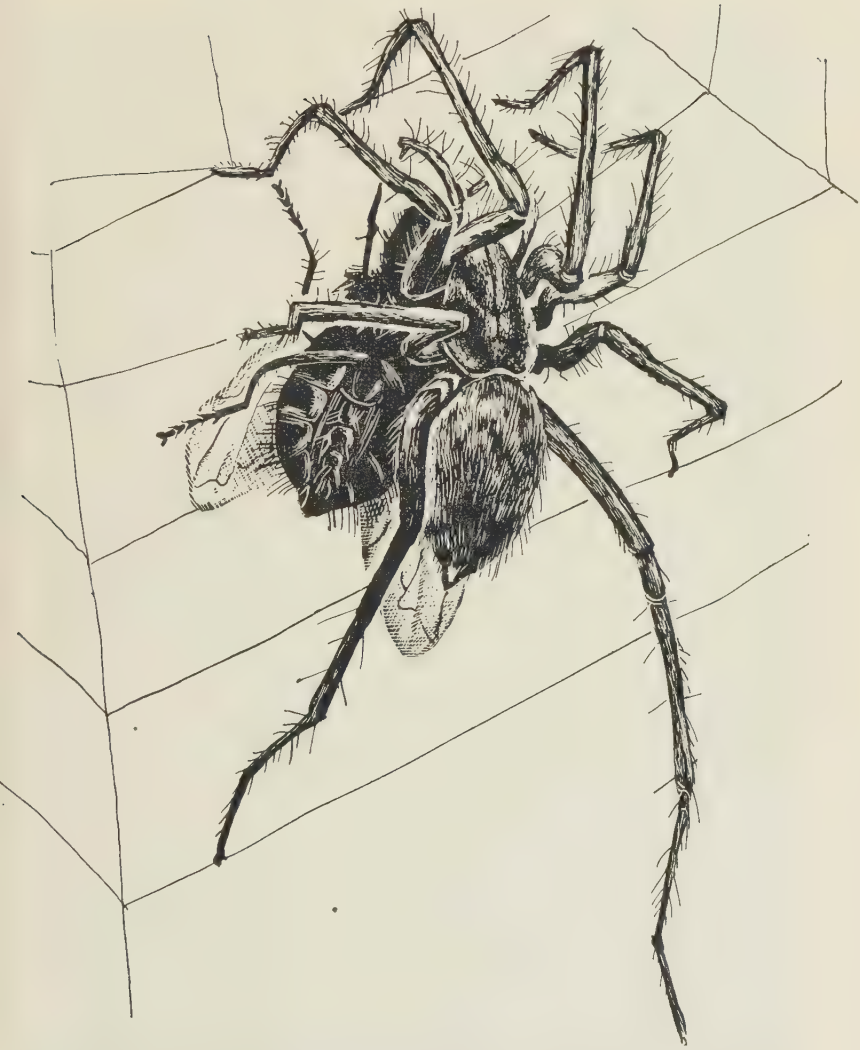
The web finished, the spider either plants itself in the middle or else runs up to a leaf to hide, and there waits patiently for its first victim. It runs a line from its web to its hiding-place, and as soon as something is

caught and the web shakes with the victim's struggles, the spider feels the pull on the line and at once rushes out to pounce on the fly. Should this warning-line be broken, the spider does not seem to notice when a fly enters its web. Its sight is poor, and it depends entirely on the vibration of the warning-line for news of its victims.

Here is a new web, just freshly made. Let us watch it. The spider is beneath that leaf at the top, waiting. Here comes a small fly. Zzzzzz! It is caught fast in the sticky threads, and the more it struggles the more tightly it is held by the web. The warning-line shakes and the spider rushes out. It kills the fly with its strong poison-fangs and sucks its blood. Then it goes back to its hiding-place.

Here comes a much bigger fly, and it blunders carelessly into the web. Out comes the spider, and sees that this time its victim is almost as big as itself. It must be careful. What is it doing? It is cutting the threads around the fly until it hangs suspended on only one. And now, look! It is twirling the wretched fly round and round like a bobbin, and at each twirl it lets out thread to bind him, until at last he is so well wrapped up that he cannot even move a leg! Then the spider poisons him and begins its horrid feast.

If a wasp or bee becomes entangled, the spider cuts the threads all around and sets the blunderer free. It



A SPIDER IN ITS WEB, STRUGGLING WITH A FLY NEARLY AS LARGE AS ITSELF

does not wish to struggle with such a strong, well-armed foe.

Most people think the spider is an insect. It is not, although it passes its life among insects and behaves more like them than anything else. It belongs, not to the insect family, but to the scorpion and king-crab family, the Arachnids.

You can tell, by looking carefully at the spider, that it is not an insect. Insects have their bodies in three parts—how many has the spider? Only two. Insects have six legs, and the spider has eight. It has four to eight simple eyes, but an insect has compound eyes—like a number of little windows, each facing in a slightly different direction. An insect, too, such as a butterfly, for instance, usually has four stages of life—egg, grub, chrysalis, perfect insect—but a spider has only two, egg and spider!

The spider's legs are long and hairy. At the end of each are two or three comb-like claws, and it is these that help it to run so nimbly over its web. Perhaps some of you are wondering how it is it does not get caught in its own web! It is because it keeps its legs well oiled! If we caught a spider and removed the oil from its legs, then put it back into its web again, it would stick to it just like a fly.

In September the spider is ready to lay her eggs. She spins a saucer of downy, orange-coloured silk, and

A GARDEN-SPIDER AND HER NEST

in it she places two or three hundred round yellow eggs. Then she spins another little orange saucer and carefully places it upside down on the first saucer of silk, so that the eggs are neatly enclosed in a cocoon nearly an inch in size. It is left safely in a crevice of a tree-trunk or tucked away inside a hole in a wall or post.

In a fine autumn the eggs soon hatch out, but very often they remain eggs until the following spring, when they hatch out into minute orange spiders. You may then perhaps see a small amber ball hanging from a tree or bush, and if you touch it you will be astonished to see it dissolve into a crowd of tiny orange spiders, each hanging by a fine thread! As soon as they think the danger is past they clamber back together again, tucking away their legs, making a tight yellow ball! They will eat one another when small, but very soon they each take their different ways and find a place in which to spin a tiny web. In the autumn, as I have told you before, hundreds of them seek their fortunes by flying away in the air on fine, gossamer threads.

We have just been hearing about the garden-spider and its ways. Now we will talk about the house-spider and its web, which I am sure every one of you must have seen in the corners of your house. What is its web like? Is it like the garden-spider's beautiful "cart-wheel"? No, not a bit! Its web is dark grey and dusty, usually built in the angles of the wall, and

THE FACE OF THE HOUSE-SPIDER

She is not very pretty, is she? Do you see her eight eyes set in two rows? Look at her strong fangs too.

above it is a tangle of fine criss-crossed threads. It is these that entrap the flies for the spider. The grey web below is only a platform to catch the victims when they fall in their struggles. There the spider waits to eat its meal. It has a little tunnel near by with a back door and a front door—the front door it uses when it rushes out to seize its victim, and the back door is kept for flight if an enemy approaches.

If you have a school aquarium perhaps you have seen the water-spider and its beautiful, fairy-like nest of air-bubbles. It looks a lovely little creature, because air gets entangled in the hairs on its body, and it gleams like silver as it swims about.

The water-spider builds the prettiest, quaintest home of air-bubbles! She makes a collection of bubbles, swimming up to the surface for them and then down to her home. Round the bubbles she weaves a dome-shaped, silken web, about the size of a thimble. Now she can live under water, for she has air to breathe in her nest! Here she lives, and here she lays her eggs. Each tiny spider, when hatched, has an air-bubble of its own to breathe!

If you keep a water-spider in a jar or aquarium you will see her go to the surface now and again for a new air-bubble to take to her nest.

There is not space to tell you about many other spiders. You may have seen the wolf-spider, which carries its eggs about in a white cocoon. When they hatch the spider builds a web in the bushes or grasses, and this acts as a shelter for the young spiders. The hunting spiders do not build webs as the garden spiders do, but hunt for their meals, stalking flies and leaping on them. Perhaps you have seen a little grey-black spider running about, rather zebra-like in colouring; this is one of the hunting spiders. Watch it stalking

its prey. It runs nimbly along, stays perfectly still when it sees a fly approaching, and then, with a light jump, pounces on it.

I have said enough to show you that spiders are interesting creatures—and now I hope you will look out for them and watch them at their work whenever you can.

THINGS TO DO

1. Find a web and look at it carefully. Draw it when you get home, or, if you have a notebook with you, draw it straightaway.
2. If you can find a spider making or mending its web, watch it and then tell your teacher exactly what you saw.
3. Write down three things that tell you a spider is not an insect.
4. Pretend that you are a young spider going to seek your fortune, and describe how you will travel.
5. Look carefully at the first spider you see and draw it.
6. Try to find the old Greek story of Arachne and read it. You will know why you should read it when you come to the end.

CHAPTER 6

THE RAIN AND WHAT IT DOES

IS it a rainy day? I hope it is, because this week's lesson is all about rain! Look up at the sky. What is it like to-day—blue, cloudy, grey, black? Perhaps the raindrops are pattering against the window and the sky is purple-black with angry rain-clouds.

The rain comes from the clouds, of course. How does it get up there? What makes it? It seems rather strange that water should so often fall down from the sky, doesn't it? We will find out how it happens.

Many of you have walked home through a thick mist or damp fog. When you got home you found that your coat was wet, although there had been no rain. The fog must have been wet enough to soak your coat. It was made up of water-vapour, just like the clouds. If we could walk through the clouds in the sky we should think they looked like fog, and we should again find that our clothes became damp. Clouds are simply mist or fog high in the air.

Does anyone know how they are made? It is an interesting story, and we will begin at the beginning. Think of a sunny day, when everywhere is hot. The pond in the meadow dries up a little. The puddles in

PERHAPS YOU CAN SEE HEAVY RAIN-CLOUDS LIKE THIS FROM YOUR CLASSROOM WINDOW TO-DAY?

the road disappear. The dew on the grass vanishes, and all the washing on the line becomes as dry as a bone. The hot sun has taken away the wetness, it has stolen the moisture from everything.

From the puddles, the ponds, the sea and the rivers the sun has drawn up millions and millions of tiny drops into the sky. The water in the puddles, the dew on the grass, the dampness in the washing have all *evaporated* —that is, changed into water-vapour, or water-gas— and risen into the air.

This water-vapour makes the clouds we see floating in the sky. Sometimes the clouds are high and thin, and we know they are not heavy enough to pour down

rain. At other times they are low and thick, and we expect rain at any moment from them. But what makes the clouds turn into rain? Why don't they float about as clouds for always?

When water-vapour comes up against something cold it shrinks and begins to run together as tiny drops of water. Clouds may reach a cold layer of air, a cold wind may blow on them, or they may even float against a cold mountain-side. If any of these things happen they *condense*—that is, they turn back into drops of water—and, of course, these are heavy and cannot remain high up in the sky. So down they come in a shower, and we say, "Oh, it's raining!"

Is this difficult for you to understand? Let me say it shortly again, and you will then be able to picture in your mind all that happens. First, there are the ponds and puddles drying up in the hot sun, which makes them evaporate or turn into water-vapour. This rises into the air, and after a time makes the clouds we see floating in the sky. As soon as they come in touch with something cold—cold air or a cold wind, for example—they shrink and condense into little drops of water, which, when they become too big and heavy to stay up in the sky, fall down on our heads as rain. The rain makes the puddles, swells the ponds and rivers and soaks the trees. Out comes the sun again and once more begins to draw up the moisture from them—and so begins

again the rain-circle that goes on year in and year out!

Have you a kettle boiling away on the fire or on a gas-ring? It will help us to understand what we have

been learning. See how the spout is steaming! We will take a plate or, better still, a slate, if we have one, and hold it against the clouds that puff from the kettle-spout. What is happening? Look! The slate is soaking wet. Hold it there a little longer and we shall see drops of water running down it. What has happened?

The water-vapour from the kettle touched the cold slate, shrank and condensed into little drops, just as the clouds condense into rain when they reach cold air or a cold mountain-side. Take off the lid of the kettle. That has little drops on it, too, hasn't it, although the

water in the kettle was not high enough to reach the lid. But because the lid was colder than the bottom

A STREAM TUMBLING DOWN THE SIDE OF A MOUNTAIN

of the kettle the steam condensed and the lid was covered with drops that fall back into the kettle to be boiled once more!

We need the rain's help. Trees and plants cannot grow without it. Seeds will not swell and germinate unless the soft spring rain helps them. Roots cannot grow until the rain softens the hard earth for them and

gives them the moisture they need. Countryside wells are filled by the rain, farm ponds and streams, too. As it falls the rain cleans the air for us, laying the specks of dust and grime, washing the roads and the pavements.

When rain falls on the mountain-side it sinks down and after a while gushes out again as a spring, which, tumbling down the mountain, becomes a tiny stream. This is soon joined by others, and in a short time a brook is made. This in its turn is joined by many more, and at last we get a grand river making its way to the sea. If we could trace it right back to its source we should find it in the little rain-springs that gush out after a heavy rain-storm on the mountain-side.

THINGS TO DO

1. Write out part of the paragraph that begins " Is this difficult for you to understand ? " Begin at " First, there are the ponds " down to " year in and year out."
2. Watch Mother take off a saucepan lid at home, when she has boiled something in the saucepan. Is it wet or dry ?
3. Look at a puddle on the morning of a sunny day, and look at it again in the afternoon. Is it as big as it was ? What has happened to it ?
4. Draw a picture of a mountain. Put a cloud over it, and show the rain falling. Draw springs coming out of the mountain-side, and let them join together to make a river that goes to the sea. Draw the sun shining over the sea, and put tiny dots to show how the moisture is being drawn up from the river and sea to make clouds. Colour your picture carefully.

CHAPTER 7

OUR TINY PLOUGHMAN, THE WORM

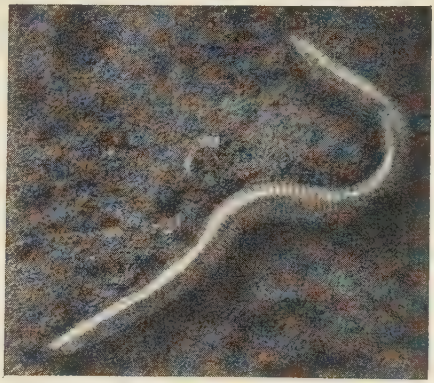
ARE you surprised to hear the worm called a ploughman? I wonder if anyone knows my reason. Think what a ploughman does. He runs his plough through the earth and turns it up, so that the soil underneath comes to the top. The worm turns up the soil too, doesn't it, and so, in its own humble way, ploughs it for us.

You all know what a worm is like, but I wonder how many of you have actually picked one up and looked at it really closely. Let us take a worm and look at it with sharp eyes. What can we see?

It has a long, round body, and if you look closely you will see that one of the pointed ends is rather flatter and blunter than the other. That is the tail end. At the other end is the mouth. The whole body is made up of rings, and if you could count them you would probably find about 150.

Put your worm on to a piece of paper and watch it. It moves by stretching out the rings at its head end and then squeezing them close together, and this action makes the tail end of its body move to catch up the front part. Did you hear a faint scratchy noise as the

worm moved over your paper? Lightly run your finger under its body, and you may be able to feel the tiny bristles that grow, four pairs at a time, from each ring. These little bristles act like feet, for the worm uses them to hold on to the ground as it moves along.



AN EARTHWORM COMING FROM ITS BURROW

The end on the left is still holding tightly to the burrow.

Although the worm has no eyes, it knows the difference between darkness and light, and can tell when it is safe to leave its burrow and when it is better to stay hidden for fear of sharp-eyed birds. It is able to smell, though it has no nose, and will burrow towards food near by. It can feel vibrations, though it cannot hear, and when it senses the movements of a hungry mole mining through the earth looking for worms or grubs, it hurriedly glides towards the surface to avoid being eaten.

Can you think why a worm is so moist and slimy? It is because it breathes through its skin, and if it should become dry it would be suffocated. The slime helps it to slide rapidly through its burrows, too.

A worm eats a number of things. It enjoys a good dinner of decayed leaves, it will feast on old roots or on anything it comes across, such as a scrap of meat, onion skins, potato parings, and so on. If there is no food of this kind handy it feeds on the earth itself, eating it as it is, digesting the tiny eggs or seeds in it and casting out the soil in the form of the worm-casts we see so often in our gardens.

Have you ever picked up a worm-cast? The next time you see one on a dry, sunny day, pick it up and crumble it in your fingers. You will find that it is very fine indeed. The worm's body has reduced it to powder! Can you think whether that helps the farmer or not? Is it a help to us in our gardening? Yes, a great help! When we plant our seeds they thrive in the fine, powdery soil at the surface, thrown up by the worms.

Is it not strange to think that all the ground we walk on out of doors has been through the bodies of countless worms! Throughout the centuries the tiny ploughmen have been steadily at work, and bit by bit they have thrown up to the top of the earth the soil from below, passing it through their bodies and casting it out powdery and soft.

This is wonderful work, humble and small though the workers are. The stale, sour soil is brought up from the depths and exposed to the air. The tunnels

made by the worms bring air to the soil below, and make little waterways for the rain, and they also help to loosen the soil, thus making it easier for roots to pierce downwards.

AN EARTHWORM TAKEN FROM ITS BURROW. A. IS THE SADDLE—A FEW THICKENED RINGS

The worm has a very small home. It lives in a narrow tunnel made by itself, usually slanting away from the surface of the ground. At the end of it is a tiny room, an enlargement of the tunnel, and here the worm curls itself up during the day. When night comes it goes up to the surface for food, hanging on to its hole by its tail whilst it ranges round about, seeking for dead leaves to feast on, or any other dainty. If you shine a light upon it you will see that it quickly slides back into its hole and disappears.

In cold weather the worm burrows deeper to escape the frost. It also plugs up its hole very tightly so that the cold and the rain cannot reach its hiding-place below, and birds are prevented from spying it and hauling it out. Have you seen the plugged-up worm-holes? They are most interesting. You will find dead leaves, bits of roots, straw, feathers, grass-cuttings, petals—in fact, almost anything used to plug up the holes.

Are there pine-woods near you? Or have you a

pine-tree near by, whose needles lie on the ground? Go and look beneath the tree. You will find that the worms living in the soil there use the pine-needles as plugs. The pine-needles are in pairs, each pair joined at the base—and the worms are clever enough to know that they must pull into their hole the *base* of the pair of needles! They have found out that if they try to pull in one end first the needles will stick half-way. Do go and see this curious fact for yourselves if you can.

This habit of plugging up their holes with decaying leaves is of great help to farmers and gardeners, because the leaves act as manure to the ground and make it fertile. The worm is certainly a great friend of ours!

Now we will make a wormery and watch what the worms do. Get a large glass jar and fill it with moist earth. Collect a few big worms and put them into the jar. Keep the earth moistened every few days. Put the jar in a dark cold corner and they will tunnel along the sides of the glass. At night they will throw up their castings and you will find them in the morning, earthy rings neatly cast on the surface of the soil. If you like, you can collect them day by day, dry them and weigh them, but if you do this you will need a fair-sized box of earth for your worms.

You must keep another wormery, too, to show how the worms mix up the earth in their tunnelling. Get five or six different substances, such as clay, charcoal,

sand, chalk, fibre, gravel, and put them in even layers, one after another, in a glass jar. See that they are moist, of course. Put in the worms. Now you will see an interesting thing happening day by day. Those straight, neat layers will gradually become crooked as the worms tunnel here and there —and in the end they will all be so much mixed up that you will hardly know which is which ! This is a very interesting experiment, and one I know you will like to try.

A WORMERY

Left : A Wormery before worms have lived in it. There are six different layers of material, A—F.

Right : The same Wormery after the worms have lived in it for some time. They have mixed up all the layers by their tunnelling.

You can make yet another wormery, to see the way in which the worms plug up their holes. Fill a big jar with moist earth, press it down, and put in your worms. Stand the jar in a very cold place, or the worms will not plug up their holes. Put on the surface of the earth in the jars a collection of different things, such as one or two dead leaves, a live leaf, bits of straw, a bit of string, a few petals, a few stalks, a couple of pine-needles, and a few tiny pebbles. The next morning, you will see that the worms have been hard at work,

and have chosen some of the things you left them to plug up their holes.

And now I hope that after all you have heard about the good deeds of the worm, you will say next time you see one, "Pass, friend, all's well!" instead of chopping the poor creature in half with your spade!

THINGS TO DO

1. Go out one night with a torch and see the worms outside their holes. Watch them hurry back when you shine the light on them.
2. Draw a worm, showing how its body is ringed from end to end. Look at one carefully, before you colour your drawing, to see what colour it really is.
3. Write down three ways in which worms help the farmer or the gardener.
4. Write down two enemies of the worm.
5. Unplug a worm-hole in your garden, take it carefully to pieces, and see what it is made of. Tell your teacher next day.

CHAPTER 8

HOW SEEDS SEEK THEIR FORTUNES

THE autumn is an exciting time in the world of plants and trees. Millions of seeds are going out to seek their fortunes ! They cannot stay at home even if they want to, because the mother-plant has already arranged how they shall travel to their new homes.

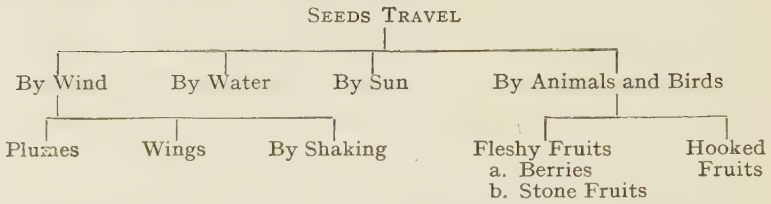
Why must they go? They are so small and a hundred fates await them ! They may be eaten, they may fall on stony ground, they may decay in the rain and damp of autumn. Surely it would be better for them to stay near the mother-plant, for she found safety where she grew.

" No, no," we can imagine the big plant saying, or the tall tree rustling, " there is only enough space, air and moisture for *me* here—if all you seeds sprouted by me we should die of suffocation ! Trees would kill their children if the seeds sprang up in the shade of their branches ; and if all the seeds from one dandelion grew in a patch together not one would be strong or healthy ! No, you must go far away from us and start your life as best you may."

Seeds travel in many different ways to their new homes : the dandelion with its little parachute flying

in the wind; the sycamore and its papery wings; the haws on the may trees, scattered about by birds. What others do you know?

We will make a little plan showing the different ways in which seeds get about.



A great many plants and trees find that by trusting their children to the wind's care they can be sure of having them carried a long way away. So they grow wings for their seeds. We have already spoken of the sycamore, and you are sure to know its double-winged fruit. Throw one into the air and watch it sail slowly to the ground. Now take off its wings and throw up the little lump that is left. It falls almost straight to the ground, which shows that the little wing is very useful, especially on a windy day. Have you some ash-keys or "spinners" to examine? The elm-tree, too, uses wings to help its children on their travels.

Some plants use plumes for their seeds, instead of wings. These are easily caught by the breeze, which takes the seed far away. You know the pretty little silken parachute of the dandelion quite well. The

SOME SEEDS TO FIND

1. Elm. 2. Sycamore. 3. Ash. 4. Old Man's Beard. 5. Thistle. 6. Poppy. 7. Sweet-pea. 8. Dandelion. 9. Violet.

thistle grows a parachute too. The old man's beard in the hedges gives a silvery-grey plume to each of its seeds, and the willow-herb, splitting its thin pod into four from the top downwards, sets free dozens of tiny seeds, each with a downy plume.

Have you a poppy-head to look at? Do you see that overhanging ridge at the top? Look just underneath it, and, if the head is ripe, you will see a great many little holes. Tip the head upside down, and out

pour the little black seeds! On a windy day the breeze shakes the poppy-head violently, and the seeds fly out.

Who can think of any seed that uses the water to help it on its travels? I expect someone will say "The water-lily," and someone else will be sure to have heard of the clever coconut! Water-lilies send their seeds floating through the water of the pond, each provided with an air-space to help it to float. At last, when they are some distance away from the mother-lily, the seeds sink into the mud, and there begin to grow.

The coconut, which grows by the seashore of hot countries, uses the sea to send its children away. You all know the coconut in its thick, light coat of fibre, do you not? I wonder if you have puzzled over the water inside it—or coconut milk as we call it. I will tell you why it is there. As perhaps you know, salt water kills young plants, and the coconut palm does not dare to give the fruit a coat that can be penetrated by the sea. Therefore it has a water-proof coat—but that means, of course, that no fresh water in the form of rain or other moisture can help the seed to sprout! So what is to be done? "That's easy!" we can imagine the coconut palm saying, "I'll put a supply of fresh water *inside* the seed! Then it can help itself to it when necessary." The coconuts roll down the shore to the sea, and the tide takes them away to another island, where they germinate and grow into palms.

TWO PLANTS AT SEED-TIME

Left: The "puff-ball" of the Goat's-beard sending away its fruits on their feathery parachutes.

Right: The feathery plumes of the seeds of "Old Man's Beard."

Perhaps you are puzzled to think how the sun helps the seeds to travel. It helps some of them in this way—it dries the seed-boxes and, by making them split or explode, the seeds are forced out with a jerk. Do you know any plant that does this? If you have ever sat on a common near a gorse bush on a hot summer's

day you will have heard a great many little explosions going on all round you, and perhaps even felt something strike you. The noise is made by the gorse-pods shooting out their seeds! The hot sun has dried the pods and they have suddenly split and twisted, sending out the seeds very sharply. The sweet-pea does this, too.

The violet has a different way. Its seed-box splits into three little boats, and as the sun dries the boat-like cases, forcing the edges together, the seeds are shot out with great force. Take an orange-pip between your finger and thumb and press it. Whizz! Away it goes —and in just the same way the violet seeds shoot out from their seed-box. The pansy does the same thing.

A great many fruits make themselves juicy, sweet and bright-coloured. The apple is one of these. Right inside it are the little brown seeds, very well protected by the fleshy apple outside. Until the seeds are ripe the apple is green, hard and sour, and no bird is likely to peck it, or human being to eat it. But as soon as the apple is ready there is no lack of eaters! We eat the sweet, juicy part and throw away the hard core that protects the seeds. This is what the apple meant us to do. "Scatter my seeds for me and I will give you a feast!" it says.

The hips and haws do the same for the birds. They prepare a brightly coloured, juicy outside, a feast for the thrush and blackbird, but inside they pack their precious seeds, which are *not* to be eaten by the birds

TWO MORE PLANTS AT SEED-TIME

Left: Seed-pods of the Broom. The pods suddenly explode and the seeds fly out. The lower pods have burst and the seeds are gone.

Right: Fruits of Goose-Grass or Cleavers, set with hooks that catch on to our clothes as we pass by.

—or, if they are, will pass right through the bird's body and be cast out far away from the parent plant. The hip makes its seeds hairy, so that the birds do not want to eat them. The haw puts its seed in a stone, like the plum and the cherry, for protection. The gooseberry makes its seeds slippery. But all make their outsides enticing and sweet, to persuade the birds to peck them.

The plants have another way in which they make

us and our dogs their servants. Some of them grow little hooks or bristles on their fruits and wait until we pass by, brushing against them. Then in a trice the hooks catch on to our woollen stockings, or to the bottom of our coat, and away we go with the little seeds, dropping them some distance from the mother-plant, not knowing at all that we have greatly helped to scatter a host of tiny seeds.

The goose-grass (cleavers) often uses us in this way, and if we take our dog with us for a country walk in the autumn we shall find that he has to help too, for his coat will soon catch up the hooks of the goose-grass. Sheep help as well. Another plant with hooks is the burdock, and the geum uses them too to make us take away its seeds.

It is fun to plant seeds that we have collected ourselves. Go into your gardens, and into the lanes and fields, and look at the plants. If any are seeding, take the seeds and put them into an envelope. Write the name of the plant on it. Then put them in a dry place for next year.

THINGS TO DO

1. Copy out the Seed-Table neatly.
2. Write down the names of six plants, and put by each the way in which it sends away its seeds.
3. Draw a sycamore key, a dandelion parachute and an apple.
4. The squirrel helps to scatter the fruits of one tree. How does it do this?

CHAPTER 9

THE CLOUDS WE SEE

I WONDER how many of you have noticed the different kinds of clouds in the sky. Most of you, I expect, because at some time or other you must have wanted a fine day very badly, and you looked at the sky anxiously to see if it was blue or covered with clouds. Some clouds bring us rain, others sail away without sending down even a drop—do you know the difference between the two? Once you learn to notice the clouds you will find that you are becoming quite a weather-prophet.

In another lesson we learnt how a cloud was made. Do you remember? When the sun draws up moisture from the puddles in the road, from the rivers, the ponds and the seas, the moisture rises into the air and becomes clouds. The water that has evaporated from the earth is changed into water vapour or water gas, and we see tiny particles of water floating high above our heads in big heaps of clouds, or in small cloudlets that seem hardly to move. A cloud is simply a mist or fog high up in the air. If we flew through it, we should be as wet as when we walk through the misty fields, or through a fog that hangs little beads of moisture on our coats.

Clouds are lovely things. Their shapes are strange and beautiful, their colours are often magnificent, and they seem almost alive as they hurry through the sky, changing their forms as they go, or saunter along very high up, like tiny feathers floating lightly on the air.

The different kinds of clouds you see have different names. I cannot tell you all of them, because it would muddle you—but I will tell you the commonest ones, and you must look out for them and watch them. You must also notice various things about them—how high they are, what colour, and whether they travel slowly or fast.

Have you ever looked up in the sky and seen little wispy, curly clouds, very high up? They may be feathery looking—like goose feathers—or streaky, or brush-like. They are pure white clouds, and their name is cirrus. When I tell you that cirrus means "curled hair" you will see what a good name those little curly, wispy clouds have. They are usually fine-weather clouds. So high up are these clouds that they are made of little clusters of ice.

Below the cirrus clouds come the woolpack clouds, heaped-up masses like packs of wool. Their proper name is cumulus, which means a heap. I am sure you all know the cumulus clouds, for you must often have said that you thought some clouds looked like masses of cotton-wool.

THREE KINDS OF CLOUDS TO LOOK FOR

Top : CIRRUS. *Middle :* CUMULUS. *Bottom :* STRATUS.

Look out of the window. If it is a warm day the sky may be filled with woolpack or cumulus clouds, heaped up high, with sharp, well-defined edges. They have lovely shadows in them, and these make the clouds look very solid. What colour are the shadows? Bluish? Purplish? Look hard and see.

That is two sorts of clouds we know—cirrus or curled-hair clouds, and cumulus or woolpack clouds. Now for another kind.

The stratus cloud is the lowest kind of cloud. It is a uniform layer or sheet of cloud, rather like a fog, but in the air instead of on the ground. It is generally a fine-weather cloud and appears low down on fine mornings and evenings.

Another low cloud you will know well is the rain-cloud or nimbus. It is a dark cloud, shapeless and ragged, and from it rain falls without ceasing. You may have seen these clouds rushing up from the west, black and shapeless, and in a short time they cover the sky, ragged and lowering, beating down rain upon us continually. Sometimes you may have the good fortune to see a rainbow hung against their blackness, vivid and enchanting, a sight to be looked for and remembered.

There are other cloud-forms besides those of which I have told you, but they are mostly mixtures of these kinds. Do you know the clouds that make what we

THE SUN LIGHTING UP HEAVY CLOUDS AT SUNSET

call a mackerel sky? A mackerel sky is a lovely sight to see—it is spread with a shoal of little pure-white speckles or flocks of clouds arranged in ripples or waves. When the mackerel sky is touched with sunset pink or gold it is most entrancing. You are sure to see mackerel skies in warm weather, so please watch for them. The French call a mackerel sky "a sky of sheep," so white and pretty are the flocks of little clouds neatly arranged in ripples and waves.

There is another lovely sky which the French people call the sky of *big* sheep. It is rather like a mackerel sky, but the clouds are not so fine-looking, nor are they pure white. They are fleecy-looking, and

each little cloudlet is dark in the middle. Sometimes you may see this sky at night, with the moon shining brightly in the midst of big waves of little clouds that cover the greater part of the sky.

On a fine summer's evening look high up in the sky and see if you can find mares'-tail clouds. They are really cirrus clouds blown by the wind into long wispy tails, like the tails of horses. Are they going slowly or fast? Watch and see.

Who knows the thunder-cloud when he sees one? It is a mixture of the woolpack cloud and the rain-cloud. Have you seen a cloud towering up like a mountain in the sky, rising up in monstrous towers, giant-like and threatening? That is the thunder-cloud, often seen before a thunder-storm. "Beware!" it seems to say. "Beware! I have thunder and lightning in my heart!"

As the clouds sail smoothly and silently through the sky they change their shapes. Sometimes they alter swiftly, sometimes they throw out wispy fingers, or leave feathery streaks behind them. They change because of two things—the wind and evaporation, due to reaching warmer air. The big woolpack clouds often alter their shape very quickly, and are fascinating to watch.

The loveliest skies are seen at sunset and at sunrise. Who has been up early enough to see the sun rise on

a summer's morning? Did you peep out of the window and see the sky? Perhaps it was deep gold, with every cloud painted to match, or maybe it was rose-pink with the eastern edges of each cloud beautifully tinted. Watch for the sunset skies too, especially those of you who live by the sea, for then the sinking sun not only paints the sky but the waters also, and you will be amazed at the marvellous spread of glowing colour.

THINGS TO DO

1. The first chance you have go to a hillside and watch the clouds.
2. Keep some sort of chart or notes of the clouds you see.
3. Write this down:

Evening red and morning grey,
Help the traveller on his way.
Evening grey and morning red
Pour down rain upon his head.

4. Draw three sorts of clouds you know. Use white chalk on tinted paper.
5. Write down a full description of the clouds you see from the window to-day, remembering to give height, speed, colour and shape.
6. On a fine dry day lie down on your back in a field or on a hill and watch the clouds sailing by far above you.

CHAPTER 10

OUR CATS AND DOGS

BOYS and girls have many different pets to care for—rabbits, guinea-pigs, pigeons, canaries, ponies, donkeys and white mice—but the most usual pets are cats and dogs.

A cat and a dog are very different. How are they different? Do they eat and drink in the same way? Do they fight the same, play the same, hunt the same? Not a bit! We really could not have chosen two animals more different from one another for our pets than the cat and the dog.

Look at their paws. Listen to the cat as she treads across the floor. Can you hear her? No, she doesn't make the tiniest sound. Now listen to the dog. What a noise he makes! Can you hear his claws clattering on the floor as he runs? Why is the cat so quiet and the dog so noisy? Look underneath their paws and you will see why.

The cat has soft little pads to walk on. Feel them. Her claws are pulled well back so that they do not touch the ground as she runs. She wants to keep them as sharp as needles, and she knows that if they rub continually against the ground they will soon get blunt.

Look at her back claws. They are not so sharp as her front ones. Why?

Now the dog's paws. What great, hard pads *he* has underneath! And look at his big, blunt claws, that strike the ground as he runs. He cannot pull them back as the cat can—but he doesn't want them to be sharp, so he doesn't mind. He uses them for digging, very often, and sharp claws would be of no use to him for that. He likes to go for long walks, or to scrape about for rabbits or rats, so he wants hard pads that will not get sore or tired. The cat doesn't like to go walking. Her feet soon get tired, for her soft pads cannot stand much wear.

The cat keeps her claws carefully drawn back into a sheath for protection. Only when she scratches or pounces on something does she put them out—and what damage those pointed, curved weapons can do! Watch her when she stretches herself and puts out all her claws as she does so—aren't they long and cruel-looking?

A dog loves to lick your hand. He has a smooth tongue, and we don't mind his affectionate lick. But a cat's lick is very different! It is like a rasp or a file—if she licked us for long we feel that she would lick our skin away! Even a kitten's tongue is rough.

All the dog family have powerful teeth, but smooth tongues. All the cats have sharp and rough tongues.

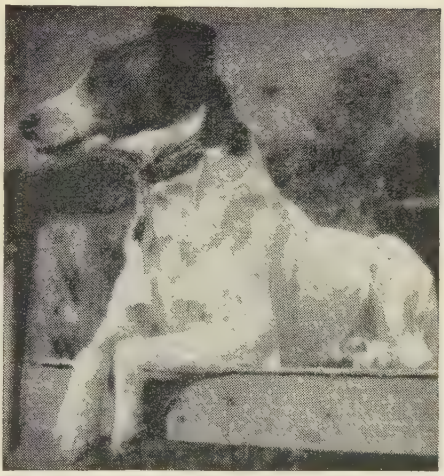
When the dogs eat they crunch up bones and meat together—there is nothing left to lick, so their tongues are smooth. But when the cats eat they cannot crunch up big bones—they can only eat the meat. They gnaw some of it off the bones, and the rest they scrape off with their rough tongues, leaving the bone clean and bare. Their tongues are studded with lots of little hooks, all pointing backwards, and it is these little hooks that make their tongues feel so rough.

PAT, MY SIAMESE CAT

The dog makes a great noise of gobbling and gulping when he eats, and he can empty his dish in two minutes! The cat never hurries, not even if the dog is just behind her, ready to gobble up everything. She nibbles daintily, and laps slowly.

When these animals were wild, long long ago, they learnt their table manners then, and nothing will alter them now. The dog hunted in a pack with other dogs, and

when they found food, they all fell upon it at once. They did not wait for one another—any dog who waited would find nothing left! So they all gobbled and gulped in a hurry, and the dog cannot stop himself from doing the same thing now.



BOBS, MY SMOOTH-HAIRED TERRIER

But the cat did not hunt in a pack. She hunted alone, and ate alone. There was no need to hurry. She could nibble and gnaw as she pleased; and she does the same still, and will never learn to do any differently. The ways she learnt when she was wild still stay with her now she is tame.

When your dog lies down, does he turn himself round and round first? My dogs always do. Long ago, the wild dogs used to sleep in reeds or in rough under-brush, and before they could get comfortable they had to tread down their beds to make a nice smooth place. It became such a habit with them that to this day our dogs still turn themselves round and round when they lie down—even if they are only going to lie down on a hard piece of linoleum!

Have you noticed that when your dog is angry, he growls and raises up all the hairs at the back of his neck? But when your cat is angry she hisses, and raises up the hair *all over her body*! Why is this? It is because a dog, when he fights, likes to get hold of his enemy's neck, and, to protect himself from being seized there, he raises up his scruff to make it thick and tough. A cat strikes another cat anywhere she can, with her claws, and to protect herself she raises up *all* her hairs, so that no matter where she is struck she is protected. She also fluffs out her tail to twice its size, and by raising all the hairs on her cheeks, makes herself so alarming that it is surprising her enemy stays to fight!

Cats have fine whiskers, but dogs have only poor ones. A cat has need of hers and uses them, but a dog has no use for his, so they are poor and feeble. A cat hunts at night and squeezes herself through many a crack and many a hole. She does not want to make any noise, and her whiskers tell her whether or not she can get through a bush or a hole without sound. How do they tell her? Well, they are just about the size, tip to tip, of the width of her body. If they are bent back by the bush or the sides of the hole she is trying to squeeze through, she knows she will not be able to get her body through without noise. So she draws back her head and pads round another way. If her

WHEN DOGS FIGHT THEY RAISE UP THE HAIRS ON THE BACKS OF THEIR NECKS. WHY IS THIS?

whiskers only *just* touch the sides of the hole she knows she can get through quietly, and she does so.

So, you see, her whiskers act like eyes to her in the dark. A dog does not hunt at night, nor does he try to be quiet, so he does not need big whiskers. Dogs hate to be alone in the dark. They are afraid some enemy will get them, so they are always on the watch, listening for the slightest sound. If they hear the softest footstep they bark loudly—and this makes them good watch-dogs. Cats would let a dozen burglars into the house.

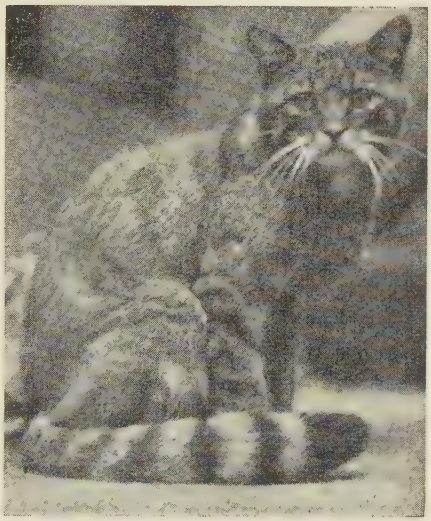
People will tell you that a cat can see in the dark. She cannot see in the pitch-dark, but she certainly

can see in the ordinary dark of night-time. Her eyes are made in such a way that they can take in every single ray of light there is, however poor. Look at your cat's eyes now. Do you see that straight slit of black? Look at the eyes of the girl or boy next to you. He has a black circle in the middle of his eyes, hasn't he? It is called the pupil of the eye. In bright sunlight our pupils get small—in a dark corner they swell and become large to take in all the dim light there is. The cat's eyes work in the same way.

At night-time that black slit expands until it covers the whole eye—and the cat sees quite well, even though the night seems very dark to us. The big black pupil gathers in every ray of light there is, and the cat sees all it needs.

A dog is a splendid friend and an eager alert companion. He soon learns to obey, he is always ready for a game, and he will do almost anything for his beloved master. What makes him such a good friend and comrade? Well, before we took him for a pet, he lived with many others of his kind, and they roamed about together. The dog learned to obey his leader and to respect him. He learnt to play with his comrades. He became a good comrade himself. Now he has no dog-leader to follow and obey—so he loves and respects his master instead. He is still ready to play, but with us, instead of with the pack.

The cat is quite different. She will only play if *she* wants to. She will rarely come when she is called except at meal-time. She will only be friendly if she wants a warm lap to sit on. These "standoffish" ways she learnt before she became a household pet, for when she was wild she lived by herself, as we heard before. She did not learn comradeship and friendliness as the dogs did. She thought only of herself, and it is difficult for her to learn new ways.



I LOOK TAME AND PEACEABLE, BUT I AM A WILD CAT, AND NO ONE WILL EVER SUCCEED IN TAMING ME

A cat lashes her tail from side to side when she is angry, but a dog wags his when he is pleased. Watch two dogs meeting one another. They are each afraid that the other is going to bite. See how stiff they make themselves, ready to fight. Their hair rises on their necks, and their tails are still. Then one of the dogs begins to wag his tail, the other dog sees it and wags his! It is a signal that "All's well!"

When you meet a strange dog you must remember that you have not a tail to wag to tell him you want to be friends, and if you suddenly put your hand out to stroke him he may think you are going to hit him, and he will growl. Let him sniff your hand, and watch for his tail to wag. As soon as it does, say "Good dog!" and he will be your friend. But ALWAYS wait for his tail to wag, and never make a sudden movement to a strange dog, for remember that he doesn't know whether you are friend or enemy, because you haven't a tail to signal to him with.

There are some silly children who think it is fun to tease an animal, and until a cat or dog knows that you are the right kind of child, not the wrong, he will be wary of you. But animals soon know when children like them, and are eager to be friends.

THINGS TO DO

1. Write down two ways in which a cat and dog are different.
2. Pretend you are a dog gobbling down a meal. Write down how it was that you learnt such bad manners.
3. Pretend you are a cat. How do you manage to hunt so well at night?
4. Draw a cat and a dog, and give them names.
5. Write down the different kinds of dogs you know.
6. Take a dog out for a good walk when you can and try to make him a friend.

CHAPTER II

THE CHEEKY HOUSE-SPARROW

I AM sure there cannot be a single boy or girl in the whole of the kingdom who does not know the cheeky house-sparrow. You have seen him every day. He eats the rubbish in the road, he steals the corn from the farmer's fields, he hops jauntily about our gardens, and he is the first to visit our bird-tables to see what he can find there. Only the boy or girl who lives in very hilly districts, or in some of the islands of the Outer Hebrides, will say they do not know him well.

We know him well—but who can describe him exactly? What colour is his head? What colour are his cheeks? Has he a dark eye-stripe? Does he wear a dark bib? Are his wings barred?

Look at him carefully next time you see him. Perhaps he is on your bird-table now, so just examine him closely while I tell you what to notice.

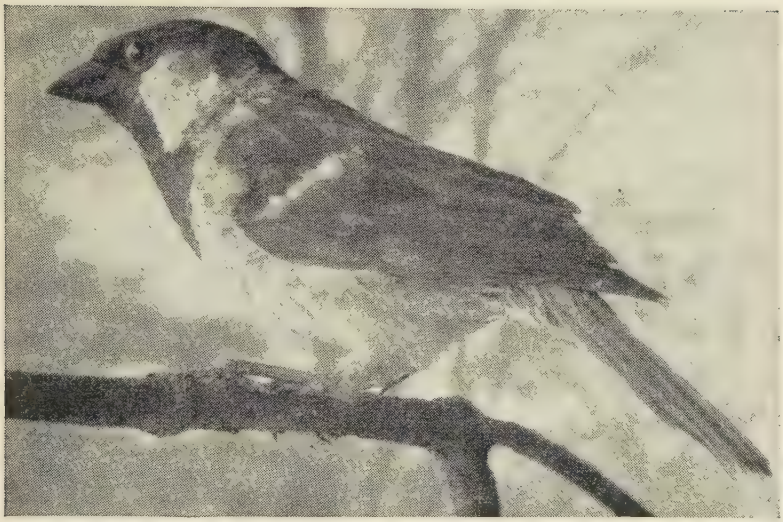
First, the cock-sparrow is darker than the hen, so if you see a dull-coloured sparrow it will be a hen. But I want you to see a cock, because, unless he lives in the heart of a city, he is quite a handsome bird. Ah, there is a cock-sparrow on the bird-table! Look at him.

See his slate-grey head, and the slate-grey colouring at the root of his tail. Look at his white cheeks and dark bill. Do you see a few dark feathers flecking his pale grey chest? Those dark specks are all that is left of the bold black bib he puts on in the spring-time. It is easy to tell which are cock-sparrows and which are hens, then, for no hen-sparrow wears a black bib. Do not forget to watch for the dark bibs when the New Year comes. You will see them gradually appearing on the cock-sparrows' chests.

His wings are bright chestnut brown, and you will see a white bar on each. The hen-sparrow's wings do not show the bar so clearly. Her dress is much duller, but her voice is just as loud!

In the olden days the sparrow was called Philip Sparrow because he seemed always to say "Philip! Philip!" Some people think he says "Chissic!" and some are quite sure he says "Chillip!" What do *you* think he says? I have heard him say all three at the top of his voice all day long, for he is a most talkative little bird, who loves the sound of his own voice! The young sparrows talk a great deal too, and in the summer-time the garden is filled with their cheerful chirrupings, when most of the other birds are silent.

Listen to your sparrows and find out what they say. They have no proper song such as the thrush and blackbird have. Besides their chirrupings they have a



THE HOUSE-SPARROW. DO YOU SEE HIS STRONG BEAK?

very harsh alarm-note, which you may hear when your cat disturbs them. It sounds like "kwurrrrrrk!" or "churrrrrrrr!"

What do your sparrows eat? If they feast on your bird-table you will soon have noticed that they ate anything and everything. They will gobble up the seeds, they will devour the potato scrapings, feast on the soaked bread and finish up the crumbs of fat left by the starlings.

It is because they will eat anything that there are such great numbers of them. In a hard winter many of the insect-eating birds perish. The kingfisher,

unable to pierce through the frozen water, dies, too. If the little tits can find no nuts or fat put out for them they starve to death. But not the bold sparrow! *He* can always enjoy a meal of some sort. If insects are about he will eat them. If there are seeds in plenty he will devour those, too—and if there is nothing to be found but road rubbish, he will make a hearty meal off that. He pokes his little dark beak everywhere, spies the tiniest crumb, sees when the peas are ripening, and is delighted when the farmer's corn is getting ripe.

He is a sharp little bird, wary and suspicious. He does not trust us, and this is why he never becomes as tame as the friendly robin. He likes to live near us, he likes to build his nests about our houses if he can —but he does not want to make friends. The robin will soon be tame enough to fly to our shoulders, or to sit on the arm of our garden chair—but the sparrow will rarely be tamed, and looks at us suspiciously out of his sharp black eyes.

All the seed-eating birds have the same strong, heavy-looking beaks. Watch a sparrow rolling a hard seed round and round in his beak, trying to break the husk and get at the kernel inside. Then crack! His strong beak splits it at last, the husk is spat out and the seed swallowed. Some seeds are very hard indeed, and the sparrow is glad of his strong beak, for he would

miss many a good meal if his beak were as weak as the swallow's is.

What a nuisance the sparrow can be! Has he ever

THE COCK SPARROW BRINGS A TIT-BIT TO HIS MATE

visited your garden in the spring-time and nipped off your primrose heads or spoilt your yellow crocuses? He comes to my flower-beds in February and thinks he will lay low all my pretty crocuses—but I know his little ways, and I place strands of black cotton here and there over my flowers. As soon as he feels his feet entangled in the cotton, the cheeky sparrow gets a fright, and flies into the air at once. He warns all the other sparrows, and they leave my crocuses alone!

The sparrows nip off fruit-buds, too, and pull up young seedlings, especially peas. When the corn is ripening in the fields, great hosts of them migrate there, and the farmer is not pleased to see them, for they peck out the grain of the corn and scatter as much as they eat, destroying the value of the crop wherever they go. I often see sooty, dirty little sparrows in the cornfields here in the late summer, and I know that they are the town sparrows come to join their country friends in a feast of corn.

In the springtime the sparrow makes up for some of the harm he does by eating harmful insects and grubs and taking them to his young ones. He also eats the seeds of weeds when he finds them, so that in some ways he helps us—but I am afraid he hinders more than he helps!

Many of you will have had a sparrow's nest built under the eaves of your house, perhaps at the top of a gutter-pipe. You will certainly have noticed one thing about it—and that is its untidiness! As long as the nest holds together and is warm and soft, that is all that matters! His nest is lined with scores of soft feathers, and he likes it. He robs the hen-roost at nesting-time, and haunts the pigeon-house. A very bold sparrow actually went so far as to hop behind one of my pigeons that was basking on the grass in the sun, and tug at a feather in its tail!

THE HEDGE-SPARROW'S NEST WITH EGGS

Sparrows build in many queer places. They prefer to build somewhere about our houses, in a hole in the thatch or wall, or in the ivy. But one pair actually built their nest in the cartridge-box of a gun-carriage —and the gun was fired off each day! It must have been a very noisy home. Another pair built a most curious nest near a clockmaker's, making it entirely of watch-springs discarded by the man at his work.

Sometimes the old nests of other birds are taken. Often a house-martin returns from the warm lands to

the place where it nested the year before, only to find that its old nest is occupied by sparrows, who have lined it with wool and feathers. Indeed, the little robbers will even turn out house-martins from a new nest if they want it, and smash the eggs. They will build in the bottom of old rooks' nests, and rob woodpeckers of their holes. If they build in trees they make a domed nest with an entrance at the side, near the top.

I expect you know the eggs quite well. They are usually grey-white speckled with black, brown or grey. The hen lays two or three clutches each year, and in the late summer our gardens are full of little Philip Sparrows, all chirruping at the top of their shrill little voices.

THINGS TO DO

1. Look at a cock-sparrow carefully. Draw him and colour him.
2. Listen to the chirrup of a sparrow and tell your teacher what you think he says.
3. Write down three ways in which a sparrow makes himself a nuisance to us.
4. Why does the sparrow have such a strong beak?
5. Look out for a sparrow's nest in the early spring, and watch how it is made, noticing what is used for it.

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WINTER

In addition to the seasonal books, there is a library edition, containing the four books under one cover, bound in cloth boards

LONDON

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MONTAGUE HOUSE, RUSSELL SQ., W.C.1

Green Hedges,
Penn Road,
Beaconsfield,
Bucks.

Dear Boys and Girls,

I wish you could come with me and walk over the hills, through the fields, and down by the river, finding a hundred exciting or beautiful things by the way. I should like to take you fishing in the ponds, and fill your jars with snails and tadpoles. I should like to help you to make a fine bird-table, or to prepare a splendid aquarium. I should like to give you a garden of your own, and show you how to make it a place of bright colours and sweet scents.

But I cannot do all these things—so instead I have written these four books for you, so that you may read them and do for yourselves all the things I would like to do with you. We will go round the year together, and you must discover with your teacher and your friends all the exciting things there are to be found in Nature study.

Good luck to you in all your Nature work, and may you find as much delight in using these books as I found when writing them for you!

Enid Blyton

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CHAPTER I

HOW THINGS MAKE READY FOR THE WINTER

SHALL we go hunting in the countryside this winter to see what we can find? So many animals and insects have disappeared, and it would be fun to see if we can find a few of them. What has happened to them all? Where are the wasps, the butterflies, the frogs and toads, hedgehogs and snakes? Where are the bats we saw every evening in the summer, and what has happened to the lively squirrel?

The winter is cold and food is scarce. Animals and insects must make up their minds to do one of three things if they are to live safely through the winter. They can travel far away to countries that are warm and plenteous—and this many of the birds do, as you know. Or they can curl themselves up in some sheltered spot and sleep through the winter frosts—or they can remain awake and face the hardships of the cold days, trying by means of thicker coats to fight the frosts and bitter winds. Many hungry days will be theirs and many shivering nights until the sun shines warmly again and spring comes over the green meadows.

Suppose that you were as small as a hedgehog or

toad and did not mean to keep awake during the winter, what would you do? One morning there would be a nip in the air, a nip so sharp that it seemed to shrivel you up. You would crawl about looking for food, and it would be hard to find; but you would not be very hungry, because you would certainly have had a fine feast in the summer and become fat and flourishing. As the day wore on and no sun appeared you would fear the night and its sharp frost. Then an idea would creep into your mind—"I must find a good hiding-place where I can sleep safely."

Where would you go? Think of all the places you could hide in with safety. You could creep under big stones, or cuddle into a hole in a bank. If you were sensible you would line your hiding-place with something warm, such as dead leaves or moss. Where else could you hide? Yes, in a field drain-pipe or in a hollow tree; what about in the wood-pile or in the middle of last summer's rubbish-heap? An old nest would be a good place, wouldn't it? A corner of a dark barn would be excellent, or underneath the roots of a tree. Both places would be dry. Then there is the thick ivy growing up the wall. It keeps its leaves all the winter and would make a fine shelter.

There are many places to choose from, and you would go on a journey of discovery, trying first this

A TOAD HIDING IN A DITCH

place and then that, and at last you would curl yourself up in the one most suitable to you and there fall fast asleep. You would *hibernate* all the winter—that is the name we give to the long sleep of animals and insects—and when you woke up in the spring-time you would feel rather thin and weak, but the sunshine and food you would find would soon put you right.

All the places we thought were good for hiding in are chosen by some creature or other. The toads like a damp spot and prefer to creep under a stone or squat at the bottom of a moist ditch. Their cousins the frogs can often be found in wet ditches, too, but sometimes they prefer the bottom of a pond. Both

toads and frogs are cold-blooded creatures—that is, their body temperature is the same as the outside air—so that you can imagine when a very frosty day comes frogs and toads are so extremely cold that they can hardly move about, and have no wish to do so. All they want is to stay still in some sheltered place.

Newts, too, like damp holes in ditches or at the sides of ponds or streams, and they curl themselves up together and sleep soundly. Young newts prefer sometimes to stay in the pond with the fish. They keep at the bottom, where it is warmer, but even if they are venturesome and swim to the top, where they become frozen into the ice, it doesn't matter—they will thaw out in the spring-time perfectly strong and vigorous! Goldfish in out-of-door ponds often get frozen at the surface, but take no harm.

The badger, who has left his old name, Brock, in many a village name, such as Brockenhurst and Brockley, likes to be comfortable in the winter. He digs out a good deep room in the hillside or wood, and then brings in hundreds of dead leaves to make his cave warm. He blocks up the passages leading to his hiding-place so that the cold may not creep in (and also so that enemies may be kept out!) and then, when the cold days come, he takes all his family into the hiding-place, where they settle down together for a long sleep. If a warm spell comes, the badger

unblocks a passage and puts his nose out to see if there is any chance of picking up some food. He is, as you see, not such a heavy sleeper as the toads or frogs, who rarely wake up during their hibernation.

The squirrel, too, is not a heavy sleeper. He likes to make careful preparations for a cold winter, but he does not mean to sleep all through it if he can help it. No, he intends to wake up and have a nibble at something. You all know what he does, don't you, when the nuts are ripening? He plucks

A BADGER BRINGING IN DEAD LEAVES TO MAKE HIS CAVE WARM

them from the twigs and then hunts about for a good hiding-place for them. Sometimes he pops them into a hole in a tree, sometimes he hides them in the ground. He probably forgets a good many of the places, and mice discover some of them and feast in delight—but there are enough left for him, should he need them.

He takes a rook's old nest, or a magpie's, and builds it up for himself. Sometimes he builds quite a new nest out of twigs, moss, leaves and bark, a big affair called a "drey." Here he curls himself up when the frosty days come, and sleeps in warmth and comfort. As soon as a sunshiny spell comes he stretches himself and opens his bright eyes. Out of the nest he scrambles, and at once remembers his hoards of nuts. Off he goes to find them, and has a splendid meal before the cold night drives him back to his drey.

The hedgehog, too, is a light sleeper, though not so light as the squirrel. He likes a nice dry hole in a bank and he is sensible enough to find dead leaves and moss and make himself a warm and comfortable bed. He cuddles down, rolls himself into a prickly ball and says good-bye to the cold days. He is fat when he begins his sleep, but when he awakes, on warm winter days, he is thinner and feels hungry. He may perhaps explore a ditch or two, looking for a hidden beetle or chrysalis before he sleeps again.

A HEDGEHOG LOOKING FOR A COSY SPOT FOR THE WINTER

The little dormouse fattens itself up well before hiding away for the winter deep underground, and it also stores up hazel nuts for a feast when it wakes, as it occasionally does. It sleeps very deeply, becomes exceedingly cold, and hardly seems to breathe. The tiny harvest-mouse spends the winter in a burrow, and near by it stores a little pile of grain so that it may not go hungry should it wake. Sometimes it passes the cold days in a hay-rick, where it is so warm that it does not sleep, but can be seen wide awake.

Caves and barns are favourite places for winter shelters. Do you know of any near your home? Go and look there, taking with you a torch or a bicycle lamp. You will find many creatures! Look up into the corners. What are those queer-shaped things hanging upside down by their feet? Yes, they are bats, all fast asleep! When they begin their winter sleep they are fat, but they get thin as the winter passes, for their bodies draw upon the stored fat and use it up. If a warm day comes, the bats wake up and fly about the barn, looking for insects.

Are there any insects in the barn or in the cave? What are those in the dark corner up there? Flash your lamp and let us see. Can you tell what they are? Butterflies, hibernating together! They are brimstones, tortoise-shells and peacocks. When the spring days come again we shall see them sailing happily in the air, their wings a little ragged, perhaps, but their colours still lovely.

Other creatures are here, too—a multitude of spiders and hosts of chrysalids, besides many smaller sleepers, all of which may become a bat's dinner. In every nook and cranny they hide, as still as if they were dead. The spider crouches in her web and waits for spring to bring back her victims once more.

Where do the queen-wasps go? Did any of you find them this autumn, hiding stealthily in the folds

of your window-curtains? Some hide in the house, and some you will find huddling under the ivy outside. The bees keep to their hives, and often busy themselves in stopping up any hole or crack through which a draught comes. As you know, they store up honey for the winter, but this we take away from them. Instead we give them something sweet to eat, and this they feast on until the first spring flowers open and offer them honey.

THE BAT HANGS HIMSELF UPSIDE DOWN, AND SLEEPS THROUGH THE WINTER

The velvety humble-bee tucks itself away in a hole in the ground and sleeps soundly. Caterpillars usually change into chrysalis form before the winter, though there are some that retire into a hole in the ground and others that remain in burrows they have made in the trunks of trees. Ladybirds and wood-lice (those strange creatures that roll themselves into little

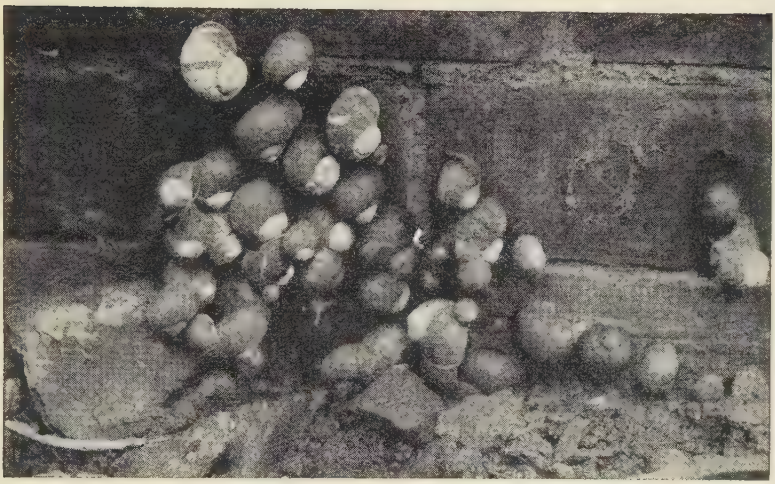
grey-black bullets) find cracks and crevices anywhere, and move never a leg whilst the very cold weather lasts.

Where do the snails go? I expect you have found some in your rockeries, or under crazy paving, or tucked into the cracks of walls. Pick one up and look at the underneath of it. Do you see the curious hard plate that seals up the entrance to the shell? That is what the snail has made to keep out the cold.

Have we forgotten any creature? What about snakes? Are they about in the winter-time? No—they are lovers of the sun, and cannot bear the cold. They curl themselves up in hollow trees, in the old nests of birds, in burrows and in piles of brushwood, sometimes quite a crowd of them together.

Our cats and dogs do not sleep the winter through, though perhaps some of our fire-loving cats would like to! They, too, prepare for the cold weather, and grow thicker fur. Horses and donkeys grow thicker coats, and, of course, sheep grow a marvellously warm winter covering. Feel your dog's coat now, and then feel it again in the summer. You will find a considerable difference.

Who has a tortoise for a pet? What happens to it in the cold days? It makes a hole in the ground and buries itself! In the spring-time it heaves itself up again, and there it is, quite lively, wandering round the garden in search of nice, juicy young leaves.



SNAILS HIBERNATING AT THE FOOT OF AN OLD WALL

Rabbits and foxes grow thicker fur, and the weasels and stoats not only grow warmer coats but, in the north, grow a differently-coloured one of snow-white, to match their wintry surroundings. In the south they do not change the colour of their coats. Farther north they grow a mixed coat of brown and white, and farther away still their entire coat is white save for the tip of their tail, which is black.

This winter you will be able to look for the hiding-places of some of the creatures I have told you about. If you find some of them, as you certainly will, don't disturb them. Leave them to sleep in peace, and when a warm day comes, go and look at the hiding-

place again, to see if its inhabitant is stirring. Look about everywhere, in hollow trees, in ditches, in the ivy or laurel, in barns and out-houses, under stones and in the cracks of your fence or wall. You are sure to find something worth talking about.

THINGS TO DO

1. Pretend that you are a dormouse, and describe some of the places which might do for a winter retreat for you.
2. Write down (*a*) how your cat or dog gets ready for the winter, (*b*) what the squirrel does, and (*c*) what the bat does.
3. When you get home go hunting in your garden or yard and see how many hidden-away insects you can find. Make a list of them, and draw one of them, or more if you can.
4. When you are out walking, look for an ivy-covered wall and hunt in it to see what you can find. Turn up any big stone and see if you can find a snail to take back to school, so that the others may see its sealed-up shell, if it has already prepared itself for winter.

CHAPTER 2

THE STORY OF FROST AND SNOW

HAVE you had any snow in your town or village yet this winter? If you live in the North of Britain possibly the snow is lying outside now! In the South we sometimes have no snow at all until the winter is far advanced—and even then it may not lie very long. Do you like watching a snow-storm? It is a strange feeling to stand at the window and look upwards when the snow is falling—there are such thousands of white snowflakes for ever appearing out of the leaden sky, falling steadily, silently downwards.

Why do we get frost and snow? Isn't it a curious thing to find all the puddles turned to ice one morning, or to see the world covered in white? What makes the frost come on the window-pane, the rime cover the trees, the snow fall thick from the sky?

I expect you have a Fahrenheit thermometer in your classroom. Pass it round carefully and look at it. Look at the number 32 on it. What is printed just by it? Yes, the word Freezing. The mercury in the glass tube is far higher than that, of course, because your room is warm; but if you put your thermometer outside one cold night the silver mercury would

gradually fall in the tube, and perhaps it would show freezing-point—it would sink right down to number 32. And then a strange thing would begin to happen to all the water and to all the moisture around. It would freeze.

What do we mean when we say that water freezes? In some way that is stranger than magic, and more powerful than machinery, each drop of water finds itself turned into ice. At freezing-point all the puddles in the road freeze, all the ponds are covered with ice, dripping water becomes solid and hangs from roofs in the form of icicles.

You cannot pick *water* up and hold it in your fingers—but you can hold it when it is solid ice. It breaks very easily when you drop it, for it is brittle.

Do you know if water takes up more room when it is liquid or when it is solid? Would a cupful of water turn into exactly the same amount of ice, or would there be less in the cup—or more? Who knows?

It is a curious thing that water, when frozen into ice, gets bigger, and takes up more room than before! Would you like to prove this for yourselves? It is quite easy. Get a lemonade or medicine bottle and fill it quite full with water. Cork it tightly and put it outside on a frosty night. In the morning your bottle will be broken!

ICICLES HANGING FROM A ROOF. THE SNOW ON THE BARN MELTED, AND AS THE WATER DRIPPED OFF, IT FROZE INTO ICICLES BECAUSE THE TEMPERATURE WAS FALLING AGAIN

The frost broke it. The water in your bottle froze hard, and grew bigger as it turned into ice. It wanted more room—but there wasn't any more room in the bottle! So it burst the glass, and thus your bottle was broken. What strength the frost had!

I am sure you have sometimes had pipes burst in frosty weather. What makes them burst? A great many people will say, "Oh, the thaw burst the pipes!" But they are wrong, aren't they? It is the frost that

bursts the pipes. The water in the pipes freezes hard and wants more room to expand as it freezes. It cannot find any more space, so it bursts our pipes—but we do not know then that they are burst, because the water inside is changed to ice, which cannot flow out of the holes made by the bursting—and only when the thaw comes and the ice changes back to water and trickles out of the holes do we see that our pipes need mending! The thaw *shows* us the bursts in our pipes, but it is the frost that does the damage!

The farmer welcomes the frost in winter-time, for it works better than a score of farm-labourers for him. Did you see the great clods in the fields in the autumn? If you did, perhaps you wondered how in the world young plants could possibly grow.

The frost breaks up the clods for the farmer. It freezes the moisture inside them, and when the frozen moisture tries to expand and find more room it breaks up the clods! The next time you walk by that field and tread on a clod you will find that it crumbles away to powdery earth—just right for tiny seeds to grow in when spring-time comes.

Have you seen the beautiful scrolls and ferns that the frost designs on your window-pane at night? Perhaps this very morning you got up and went to look out of the window—and you couldn't see out because it was all "frosted over"! The frost had

THE LOVELY FERN-PATTERN MADE BY THE FROST ON A WINDOW-PANE DURING THE NIGHT

come in the night and put pictures on the window. How did it do it? Well, as we slept we breathed out warm breath, and some of it went to the window-pane in the form of water-vapour. The window-pane was cold and the frost lurked just outside. As soon as our breath touched the glass it froze, and as it froze there came the lovely patterns made of ice-crystals that you saw when you woke up this morning.

How is snow made? It isn't frozen rain, because that would come down as small hailstones. It is frozen

water-vapour—frozen clouds! In winter-time the clouds often float through very cold air, and it sometimes happens that instead of turning into raindrops, as they usually do, they change from water-vapour into tiny ice-crystals. The crystals join together and make snowflakes. These are too heavy to float about the sky, so down they come. They are so soft and so light that, although there may be thousands of snowflakes falling around us, we never hear a sound.

Have you ever seen an ice-crystal? I should like you to see one, because I know you will be surprised at its lovely shape. To see crystals properly, you want a piece of black cloth. Catch a snowflake on it and look at it through a small magnifying glass.

You will see that the flake is made of tiny, glittering crystals—and every one of them has six sides! Catch as many as you like and count the number of points they have, and you will always find six, or a multiple of six. Some of the crystals are feathery-looking, some are star-shaped, others are plain—but all are exquisitely fragile and delicate.

Choose a day when there is not much wind when you catch your snowflakes, as otherwise they will be bruised by being blown about, and you will not be able to see clearly the lovely shapes of the crystals.

The snow acts as a warm blanket to the earth.

Perhaps you are surprised to hear that something so cold should give warmth to things!

If you weighed a pound of water and compared it

WHAT FROST CRYSTALS LOOK LIKE UNDER A MAGNIFYING GLASS. EACH HAS SIX SIDES

with a pound of snow, you would be surprised to see what an enormous amount of snow had to go to make up the pound, compared with the water. What makes snow so bulky? It is the air entangled in the snowflakes! Think of feathers, or of wool—each of those weighs very light, and a great deal of them has to be piled on the scales before the weight of a pound is reached. They, too, have air entangled in them. A little bird's body gives out heat and warms the air in

its feathers, and these keep the air in—and the heat too—so the bird is always warm, no matter how cold the outer air is. Its feathers entangle the warm air and won't let it get away.

Fur does the same, and so does wool. And now, how does *snow* keep the earth warm? Can you think? It keeps it warm because it doesn't let what heat there is in the ground get away! It holds it there, entangled in the six-sided crystals. The frost in the air above the snow may get harder and harder—but the bitter cold cannot touch the tender plants below the snow! The flakes are keeping their heat in, just as our woolly blankets at night keep *our* heat in, and make us feel warm.

When warmer days come, the snow melts and the plants drink their blanket! It trickles down to their roots and so is of use to them in another way.

Hoar frost is not frozen dew. The moisture in the layer of air next to the ground becomes frozen instead of turning into drops of dew. If we look at hoar-frost closely we shall see that it is a feathery layer of ice formed on blades of grass, twigs, leaves and so on. It is very beautiful.

When the weather is misty and very cold at the same time, the mist freezes, and we see that everything outside becomes covered with a thick layer of tiny ice-needles. This we call Rime.

When snow falls through air that is warmer than freezing-point it begins to melt—and we find that a mixture of snow and water is falling on us. This is called Sleet.

Hail is made of rain-drops frozen into balls of ice. As you know, hail-stones are very often far bigger than drops of rain, and this is because in their travels through very cold air more and more layers of ice have been added to each hail-stone, so that when at last they reach earth they may be very large indeed, and do a great deal of damage.

THINGS TO DO

1. The very first chance you have, catch a snowflake on something dark and look at it closely—with a magnifying glass if you can. Count its sides.
2. Draw a snow-crystal or a snow-scene.
3. How does the frost help the farmer?
4. How does the snow help the plants to face a bitter winter?
5. Why do our pipes burst in frosty weather?

CHAPTER 3

THE CREEPING SNAIL

OF course, you have all watched a snail creeping slowly along the ground, and thought of the saying we have when speaking of something slow—we say "At a snail's pace," don't we? It is a curious little creature, carrying its house upon its back and leaving a silvery trail behind it.

The snail cannot help being always at home, because it is forced to take its house with it wherever it goes. Why does it do such a strange thing? It must be a nuisance to have to drag one's home about always. No wonder the snail creeps along so slowly.

The snail has a very good reason for carrying its shell about on its back. Look at its body as it crawls along. It is very soft, and many birds and animals think it makes a delicious meal. To protect its soft body the snail grows a hard shell into which it can retreat when danger is near. Take up an empty snail-shell and look at it. Is it thick or thin, heavy or light, strong or frail?

It is light, thin, but very strong and hard. Even a thrush's strong beak cannot peck through it. It is like armour for the snail.

THE GARDEN-SNAIL GLIDING OVER A STONE. ITS HORNS ARE OUT, AND AT THE TIP OF THE LONGER PAIR ARE ITS EYES

The thrush is so fond of a snail for dinner that it has discovered how to defeat its armour. I have a very tame thrush in my garden called Freckles, who likes a feast of snails better than anything else. He searches the stones in my wall and my rockery each day, and sooner or later he finds a snail. He takes it in his beak to a big flint stone near the gate. Then he hammers the snail on the stone until the poor thing's shell breaks and the thrush is able to eat the soft body inside. Then off he goes once more to seek another snail, and sometimes I hear the little knock, knock,

knock of snail-shell against stone all the morning long. Dozens of pieces of shell are scattered around his anvil.

In the morning you will often see silvery tracks in your garden, and you say, "A snail walked there last night!" Follow the track and you may be able to find the snail hidden under a stone or in the close-growing ivy. A snail likes to keep the same hiding-place for itself, and when it comes out at night to search for food it will always return to the same place afterwards. I have sometimes marked snails I have found with white chalk or black ink, and sure enough they returned to the same places week after week. Would you like to do the same?

How does the snail make its silvery trail and why? It is made of slime from the snail's body, and the snail finds this very useful. Its body is soft and the ground is rough and hard. The slime acts as a sort of carpet to protect the underpart of the snail from being hurt. What a strange little creature it is, carrying its house upon its back and laying down a carpet to creep on!

Where are the snail's eyes? Can you see them? Wait until it creeps out of its shell, and then look at the two pairs of "horns" on its head. The smaller pair are feelers. The larger pair carry the eyes—right at the very tip! Look carefully and you will see them

there. They are not very good eyes, because the snail does not really need excellent eyesight; for, as we have said before, it comes out mostly at night.

It takes great care of its two eyes, however. If danger is about, the snail hides away its tiny eyes. Where does it put them? It turns its big pair of "horns" outside-in and stows its eyes at the bottom! How does it do that? Well, you can easily see what I mean by taking a glove-finger, putting a big pin in at the tip so that the pinhead represents the eye—then put your thumb and finger inside the glove, take hold of the end of the pin and pull. The finger turns inside-out—or, rather, outside-in—and the pin-head goes to the bottom. That is what happens to the snail's eyes when it "puts its horns in." Touch the horns and watch them roll inwards, and you will see exactly what I mean.

I do not need to tell you *what* the snail eats, do I! I am sure that anyone with a garden will groan and say, "Lettuces! Cabbages! Young plants!" It is a most destructive creature—a perfect nuisance in a garden. If we could see it eating we should know why it can destroy leaves so easily.

Perhaps you have a bit of cabbage you can give your snail to eat. If it is hungry you may be able to hear a curious little rasping noise, which is the snail's tongue filing off the leaf! It has a ribbon-like

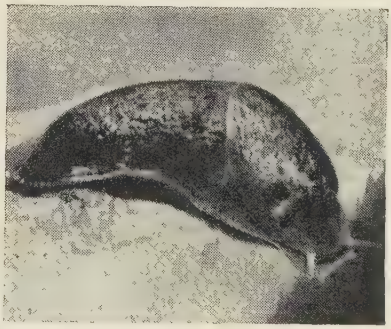
tongue set with thousands of hooked teeth, and these act like a file, rasping to and fro over the leaf. When the file begins to wear out at the tip it grows at the root, and so is always long enough for use. Have you a file in class to see? Look at it, and you will know why the snail can damage a plant so easily and quickly.

The long, soft body that comes out of the shell and on which the snail creeps is called the foot. Look at the right-hand side of the snail near the shell and you may be able to see a little hole or slit opening and closing. That is its breathing-hole.

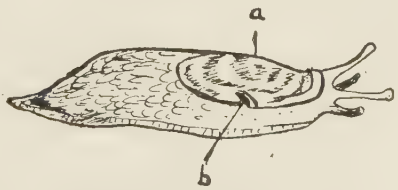
The snail always leaves some of its body inside its shell when it moves about. It grows there and cannot be removed without tearing. If the snail gets a dent or little break in any part of its shell it gradually mends itself. A new little patch of shell slowly grows in the place of the broken piece.

The snail does not like the frost. It is afraid of being frozen, and so, when cold days come, it finds a safe hiding-place and then seals up the opening to its shell to prevent the cold from getting in. It closes it with a thick lid of hard slime, leaving a tiny hole for breathing. It does not creep out again until the frost has gone, warm weather is here, and there are plenty of new young plants growing everywhere for it to feed on. Then it opens its door once again and walks out for a good feast.

The slug is the snail's cousin. It has no shell like the snail, but under its skin, behind its neck, you may find a hard piece, like a small flat shell. Some slugs have no hard piece at all, and all slugs have to be much more careful about their hiding-places than snails, because they wear no armour. They are covered with sticky slime and are most unpleasant to touch. Like snails, they love wet weather, because then the ground is softer to their bodies and they can crawl about easily, using little of their own slime. With their rasping tongues they do even more damage than snails, and a dozen may completely destroy a row of young lettuces in a night.



ONE OF OUR GARDEN ENEMIES—THE BIG BLACK SLUG



a. SHELL OF SLUG
b. BREATHING-SLIT

Perhaps in your gardening you have come across little batches of tiny white eggs, two or three dozen together. These are snail eggs. If they are rather jelly-like they are slug eggs. The robin who sits by me when I garden flies down to eat them when

I turn them up, and I am glad to see him do so, because I know that there will be so many snails or slugs the less to eat my lettuces and my cabbages!

The tiny snails hatch out of the eggs complete with their shells, and soon grow as they feed ravenously each night on tender young plants. They go on growing for about three years, when they are full-grown, and they lay hundreds of eggs each season.

Would you like to keep a snailery for a few weeks? It is rather fun. Get a box and put into it some damp earth, some grass, and some fresh leaves. Then put your snails in. Cover the box with a piece of muslin. You can now watch them eating, creeping and resting. Put fresh leaves in each day, of course. If you put your box outside on the window-sill for a few cold days you will see how the snails close up their shells with a hard little door.

THINGS TO DO

1. Look for snails in the park or in your garden, and find out where they like to hide.
2. Look for a thrush's anvil, and if you find one watch for the thrush to use it.
3. Make a snailery of your own at home in a shed. (Your mother may not like the snails in the house.)
4. Draw a snail in its shell. Draw a snail creeping along.
5. Where are a snail's eyes?
6. Why does a snail leave a silvery track?
7. How does a snail eat?

CHAPTER 4

MAKING FRIENDS WITH THE BIRDS

THIS winter we are going to make friends with the birds. We shall never know them really well unless we can bring many of them near enough to watch their ways and hear their calls. We shall have an interesting and exciting time, and you will have many a tale to take home with you in the winter.

A great many of you, I know, already have bird-tables in the winter-time, but a much larger number have nothing at all to attract the birds to your school. Even if you are a school in the heart of a town you can *still* bring numbers of birds to you, so please do not think that this lesson is only for the more or less country schools. It is for all and every school, and it does not matter in the least whether you know anything about the birds or not—you soon will!

The first thing to make is a bird-table, on which you can spread all kinds of different food for the birds. You can make this as simple or as elaborate as you wish. In its simplest form it is merely a square piece of wood nailed on to a post or pole out of the reach of cats. Put it as near your window as you can, because you will naturally want to see the birds closely.

There is sure to be someone in the class who likes making things with wood, and it won't be long before your table is up in its place. I have a rim round mine to prevent the food blowing off on a windy day, but otherwise it is simply a pole stuck in the ground with a flat piece of wood nailed on the top. One of the sides has no rim, as I like to scrape the bird-table each day to rid it of stale food or bird-dirt, and it is easy to scrape it off the unrimmed side with a piece of wood, the scrapings falling into a shovel or piece of newspaper. Once a week or once a fortnight it should be well scrubbed with soap and water to keep it clean.

Now we will imagine that your bird-table is up, not far from the classroom window. There it stands, ready for its visitors. What shall we put on it to attract them? Think hard and make a list of the food you know the birds will like. We cannot give them worms or insects, but there are plenty of other things we can bring from home, and many others we can go out and collect from the fields and lanes.

What have you put on your lists? Bread, I am sure! Most birds will eat that. Shall we begin with that? Soak it in water if it is stale and hard, and then put it on your table. Who will come for it first? Watch and see.

It is almost certain to be a bold sparrow. He spies it from the roof of the school and knows it to be bread—but he hasn't seen it in that place before. He must go warily, in case it is some sort of trap.

After a while down he comes to the ground. He is not going to sample that strange-looking table yet. Perhaps there are a few crumbs underneath he can have. Yes, there are! He pecks them up, and then cocks his head on one side, looking up at the table. Dare he fly up? No, he really doesn't think so! Suddenly down fly two or three more sparrows, and begin to hunt for crumbs underneath the table. They have seen the first one, and know that food is about. This decides the sparrow—he had better fly up to the table

before the others have a look in; and up he goes perkily, and is soon feasting on our soaked bread. The others join him, and there is our bird-table with quite a crowd on it within the first hour!

We may get a robin that day, too. He prefers to feed alone. He does not like the company of common sparrows, so he chooses a good moment and then flies daintily down to feast. He sings a few creamy notes, and then flicks off again. But he will come again to-morrow. He has made up his mind that it is his table, put up mainly for him, and he will make himself quite unpleasant to the other birds there! He loves to be friendly and tame with us, but to his own kind he is stand-offish and not very polite.

If we put out only bread we shall not get very many birds besides the soft-billed or insect-eating birds. These, like the robin and thrush, feast on worms, slugs and insects—soft food. Other birds, such as the chaffinch and bullfinch, feed on seeds or grain, and they are called hard-billed birds, because they like hard food. We must remember them, too—so we will put out seed for them, and see who comes for it.

The sparrow, a hard-billed bird, will eat practically anything, so he will devour bread or seeds with equal greediness. We will buy some hemp seed at a seed merchant's and put a little on the table. How the sparrows enjoy it! And see, here comes a smart little

bird, looking as if he has just had a wash and brush-up! His chest is rosy, and his head slate blue. His wings are boldly barred with white. He pecks up the seeds rapidly, and we say, "Look! There's a chaffinch!"

We may get greenfinches, bullfinches, hawfinches as well, to feast on the seeds provided. I cannot tell you how to recognise them all, but you will find a book of birds with coloured pictures very useful to you. You can also buy coloured postcards of birds, and pin them on the wall. Then you will soon learn to know the birds that come.

Here is a list of food you can put on the table, besides the soaked bread and hemp seed. Any of these: soaked dog biscuit, scrapings of porridge, cold boiled potatoes (a potato in its jacket will be a great treat sometimes), scrapings of milk pudding or suet pudding, most household scraps (not fish or cabbage), currants, fat or suet, a meaty bone, bacon rinds, cheese rinds. Also you must keep your eyes open when you walk in your garden or out in the country, and bring back with you hips and haws, elderberries, blackberries, rowan berries (mountain ash), privet berries, ivy berries (in the New Year when they are ripe), yew berries and honeysuckle berries. Please remember not to eat any berries strange to you, as most of them are very poisonous. The yew berries, for instance, loved by the birds, are deadly poison to us and to animals.

Then you can collect green food for the bird-table, such as groundsel or chickweed. You can save old sunflower heads and hang one from the side of the table. You can collect the seeds of poppies (wild), plantains and shepherd's purse, and save them up for later on, when the birds will be glad to have them on the table. Pick thistle, dandelion and knapweed heads, and you will find that your bird visitors, especially the greenfinches, will be delighted to feast on the seeds.

I usually nail some branching twigs to the back of my bird-table, as I like to see the birds perching on them before hopping down to the food. You can tie your bunches of berries, thistle heads and so on to these twigs. You will probably find other food, such as ash keys, which you can dry in the sun and put away for later use, when you will not be able to find so many things in the fields for your bird-table.

Bring your household scraps to school, unless you are going to use them on a bird-table at home. If you have an old cardboard cream-carton or jam-carton, you will find it is a good plan to get your mother to put into it each night the leavings of the day. Then you can take them conveniently to school in that. Any bigger leavings you had better take in your seaside pail!

On your table please put an enamel saucer of water, and fill it afresh each day. The birds will be so

thankful for this in frosty weather, when all the ponds and puddles are covered with ice. If anyone has an enamel dish she can spare and will lend it for a bird-bath, many of the birds will be delighted to take daily baths under the bird-table.

FOR THE TITS

The seed-hopper, and, below, the tit-bell, full of fat.

I have two splendid things in my garden for the tits. They are a tit-bell and peanut feeder, and are hung 6 ins. away from my window. The peanut feeder is simply two thick circles of wood, top and bottom, with a cellulosed barrel in which slits have been cut. The tits, woodpeckers and nuthatches feast greedily on the nuts by pecking at them through the slits. There is a cork at the bottom of the feeder, and I put my shelled monkey-nuts in there, then cork

it up again. Do have one of these, they are such fun!

Now look at the wooden tit-bell, under the pea-nut feeder. If you peeped inside this you would see that it has a rod across and nothing else. I unhook it from the pea-nut feeder, turn it upside down and pour melted fat into it. When it has set solid I hang it up again. Down come the tits to feast on my bell! They hang on to the perch inside and peck away vigorously.

I also have a seed-hopper for the great-tits and chaffinches. This is rather like the pea-nut feeder, but has a wooden box for hemp seed. The box part fits loosely on to the wooden platform below, and a few seeds are always leaking out. The birds soon find these and take them. To their surprise and delight, no sooner have they pecked up the loose seeds than a few more leak out to take their place! So, no matter how long they feed, there are always seeds for them there. When there are no seeds left in the box I fill it again.*

You will perhaps think I have forgotten to say anything about coconuts for the tits. I am sure I do not need to say very much, because so many schools have hung up a coconut by the classroom window and

* Enquiries concerning tit-bells, etc., should be addressed to Mr. Mortimer Batten, Naturalist, of Pencaitland, E. Lothian, N.B.

have watched the tits feeding on it. It is best to ask the greengrocer to knock a hole in each end for you, and hang up the whole coconut rather than cut it in half. If you do cut one in half, hang the halves upside down, then the rain will not collect in the hollow and turn the nut bad.

If you buy monkey-nuts and thread them on string to hang from the bird-table, the tits will be delighted. They will hang on to the nuts and peck them vigorously, and you will find that very soon there is nothing but a string of empty shells ! (See picture on page 93.)

THINGS TO DO

1. Feed the birds at home as well as at school. Put out a saucer of water for them.
2. Make a bird-chart, and put down on it the birds that come to your table and what food they take.
3. Collect berries and seeds for the table, and take them to school for use now, or for storing until later.
4. String some monkey-nuts and hang them in your garden at home.
5. Find each bird visitor in a book about birds and read all about it. If you can find any good coloured bird pictures in magazines, or on postcards, put them up on the wall for everyone to see.
6. Write down (*a*) the food the robin eats from the table, (*b*) the food the starling eats, (*c*) what the tits seem to like the best, and (*d*) which birds eat the seeds.
7. Scrape the table clean each day, and put out fresh water.

CHAPTER 5

THE COMPASS

WE have learnt how to tell which wind is blowing, we have perhaps made wind charts, and we have learnt about the sun and its movements. So I hope we are beginning to know something about east, west, south and north and could find our way in any direction we were told to go.

Supposing I said to you, "Go out of the school gate. Turn east. Walk until you come to cross-roads. Turn up the one that goes northwards. Go down the first turning that runs westwards, and walk until you come to a road running to the south." Could you do this? Or, when you were outside the school gate, would you feel quite puzzled as to which way you should go?

If there were a weathervane or weathercock in your school-playground, you could, of course, tell at once which way to go, couldn't you? What would you do? You would simply look for east on the points underneath the vane or cock, and turn in the proper direction. Then you would know that at the cross-roads you must turn left, for that would be northwards. Take a piece of paper and quickly trace out the way

you would go. (One of you should do this, on the blackboard if you can.)

But suppose you had no wind-vane to guide you and you really didn't know which was east, west, south or north! You could still find your way if the sun happened to be shining.

You know that on these spring mornings the sun rises in the east, and in the evening it sets in the west. In the middle of the day it is at its highest point in the south. Therefore, if it is morning, you would know that the eastern direction is towards the sun; and if it is evening, you would have to turn your back on the sun in order to journey eastwards.

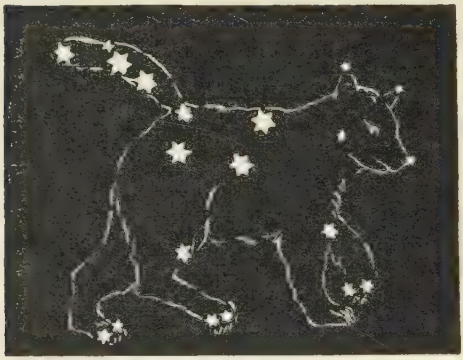
So, if you looked at the sun when you went to the school gate it would tell you whether to turn left or right in order to go east.

Suppose it were night-time and you could not see a wind-vane (and, of course, the sun would no longer be in the sky). What could you do then? You could, if you knew how to, tell which way to go by looking for a fairly bright star which is always in the north. I will tell you about it, because you may like to find it yourself to-night.

This star is called the North Star, or the Pole Star, because it is almost overhead at the North Pole. This is how to find it: look in the northern sky for the group of stars called the Great Bear. I will draw

them for you, then you will know the shape they make in the sky. Some people think they make the outline of a plough rather than the shape of a bear.

Another name for this group of stars is "Charles' Wain." Wain means wagon. Look at the shape of the group. Can you see what might be a wagon (four stars) with three horses in a line? Now take the two stars at the back of the wagon (called the Pointers) and join them by a straight line, using your ruler. Continue your line, and you will find that it runs to another star, some distance away—that is the Pole Star, which is always in the northern sky. (Can you do this on the blackboard?)



THE GROUP OF STARS THAT MAKE UP THE GREAT BEAR

Ask someone who knows, if they will point out the Great Bear, or the Plough, or Charles' Wain to you, one night. Then let your eye run in a straight line from the Pointers, and you will at once find the North or Pole Star shining. It will tell you which is the north, and you can then find out south, east and west quite

easily. Sailors use the stars a great deal in their voyages, and the sun, too, to help them in sailing in the right direction.

But now suppose that you have no wind-vane to help you, and the sun is quite hidden behind clouds. How will you know which is north, south, east or west? You will not know—unless you have a compass!

I expect you have all seen a compass. Have you one in class? Look at it. It has a needle inside that swings easily over a card on which are printed N, S, E, W, NE, NW, SE, SW and other points also. Turn the compass round and then set it down. The needle swings about, and at last points—where? To the door? To the window? To the blackboard? It will differ in every schoolroom. Find out where *your* compass needle points when it comes to rest.

Now turn the compass round again, and let the needle swing once more. What a strange thing—when it comes to rest it still points in exactly the same direction as before. It does not matter how we turn the compass, the needle will not come to rest in any other position than the one it chose the first time.

What direction is that? Who knows? Yes, it points always to the north.

The needle is a magnet, and magnets like to point to the north when they are free to swing. And a very useful habit it is, because by using magnets like this

one we have in our compass, sailors, travellers and airmen are able to find their way about in strange places, when the sun and the stars are hidden.

Perhaps you would like to know a little more about magnets. Your teacher has a large horseshoe magnet. What will it do?

It will attract to itself things made of iron or steel. Put a sewing-needle near the magnet and see it jump eagerly to the magnet and stick there even when held up in the air! Try a steel knitting-needle. That will be firmly held by the magnet too. Look at it holding it to itself. Try to pull it away. Do you feel the magnet pulling at the needle, almost as if it were alive?

Now look what a queer thing has happened? The *knitting-needle* is attracting our little needles. It has become a magnet too. See how the small needles are hanging on to the knitting-needle, which is, in turn, being held by the magnet!

Try other things with the magnet. Does it attract your penknives? What about the sewing-scissors? Try it with brass drawing-pins. How disappointing! It takes no notice of them at all. They are not made of iron or steel, you see.

Look at the little needles hanging on to the magnet. They are magnetised now. Rub the magnet over a needle (stroke it several times, always in the same direction), thus making it into a little magnet itself.

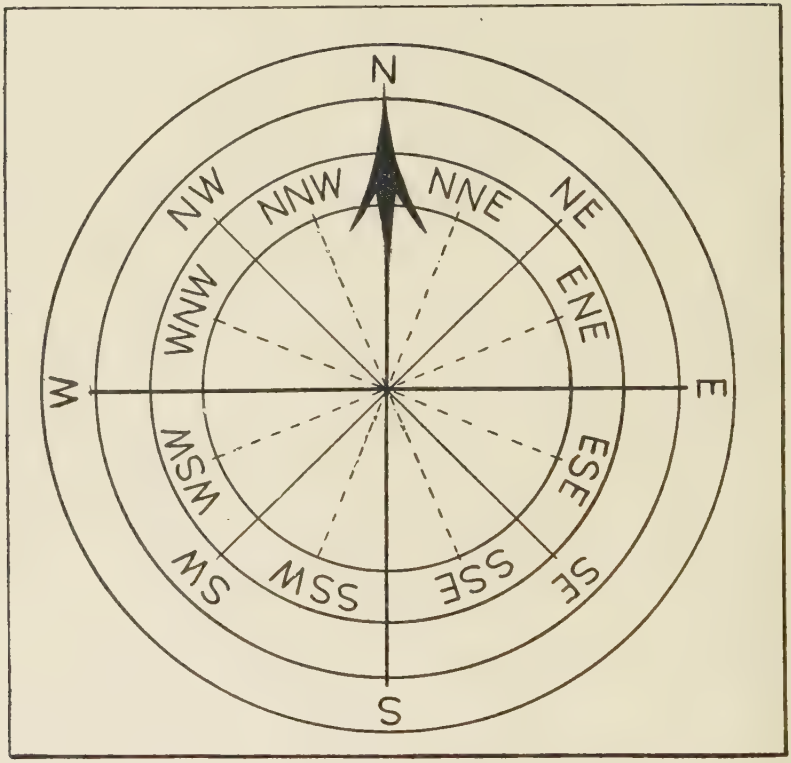
If you could put it into your compass, instead of the needle that is there now, you would find that your little needle would act like the compass needle—it would swing round to the north, and point there !

But our little needle has nothing to swing on. Can we do something with it so that it may swing easily? Do you know what the long-ago people did with their needle magnets before they found out how to set them on pivots, like the one in our own compass? They used to *float* their magnetised needle in water, and then it would swing round to point to the north.

Try floating your needle magnet in a basin of water. Put it gently on to the surface of the water. It floats beautifully, and as it floats it twists round slowly. Where is it pointing to when it comes to rest? To the north, of course ! (Needles will only float if quite dry; a slight rub with vaseline helps them to float.)

When people found out this strange fact they thought how useful it would be to put one of these needles into a box, and use it to help them in finding their way, especially over the sea, and that is how we came to have our excellent compass. It was more and more improved, and those made for big ships and for aeroplanes are most interesting to see.

If we take our compass to pieces, we see that the needle rests on a pivot, which allows it to swing easily



CAN YOU MAKE A COMPASS CARD LIKE THIS?

from side to side. Let us take off the card and make one of our own.

We can each make a compass card for ourselves if we want to. Cut out round pieces of card, as large as you can. Draw a thick line across your circle, halving it exactly, to show the north–south line. Now put N. for North at one end, and S. for South at

the other. Now you must draw the east–west line, right across the first line. Your circle should now be in four quarters. Letter in E. and W. at the correct ends.

Now draw thinner lines between the lines you already have, for N.W., N.E., S.W., S.E. You now have eight points of the compass, haven't you? Now we will have even more lines, in between all the lines you have. Make them dotted lines this time, and letter them, in their correct positions, N.N.W., N.N.E., W.N.W., E.N.E., W.S.W., S.S.W., E.S.E., S.S.E. Can anyone get them all right without help? You will have to think hard, but I expect some of you will be able to fit in all the lettering correctly.

THINGS FOR YOU TO DO

1. You know where North is. Set your card on your desk with the N. line pointing north. By the help of your card put down in what direction are—the door—the blackboard—your best friend —the fireplace—the biggest picture in the room—a vase of flowers —and a cupboard.
2. Now go out into the playground. Choose six things there and find out what direction they are in when you stand with your back to the school. Be sure you have your card set right by means of the compass.
3. What can you see from your school playground? Can you see the church? In what direction does it lie? Can you see a tall factory chimney? Or a big hill? Find out the directions from either the compass, or your compass card.
4. Make a little plan of how you come to school; put an arrow showing the north.

CHAPTER 6

OUR EVERGREENS

SOON we shall be thinking about our Christmas decorations. We shall order our holly and mistletoe, go to choose a big or little Christmas-tree, or walk into the country to find ivy and laurel or branches of other evergreens to decorate our homes and schools.

Why don't we use the prettily shaped oak-leaves for decoration, or the shiny beech-foliage? We cannot, because those trees are bare, and save for a few russet leaves still clinging to the oak there is nothing to be seen but empty boughs.

So we must choose evergreens for the winter-time, especially those with berries, because they give colour to the dark leaves and make the branches gay. And for our Christmas-tree we must choose an evergreen, too, for the dark-green branches make a fine background for our bright toys and candles.

We all know the Christmas-tree—but who knows its real name? Not one of you, I expect! Its real name is the spruce fir, and the tree itself grows to a great height. Have you ever seen one in the woods?

It is a very straight, soldier-like tree, with a reddish-brown bark. Slender branches grow straight out all

round its trunk, the lower ones sweeping downwards, gracefully, curving up at the tips. The branches get smaller and smaller up the tree, making it pyramid-like in shape, and at the very top is one spear-shaped branch sticking straight upwards. Look for this when you are hunting for a full-grown Christmas-tree.

You all know what the leaves are like, for you have seen them often at Christmas-time. They grow so neatly along the twigs, and always look to me as if someone had been along with a brush and comb and made a trim parting down the middle of the sprays! You may find some full-grown fir-cones hanging down from the branches, and if so you must look for the seeds so carefully hidden inside.

Our telegraph posts are made of the trunks of full-grown Christmas-trees. So are the scaffolding poles that are used when men are building the upper part of

a house. Our ships often have spruce-fir masts, and the fine, straight poles are excellent for that purpose. Look carefully at telegraph posts next time you pass them, and you will see then how very straight the spruce-fir tree must grow to make such splendid poles.

In Switzerland and Norway the spruce firs grow in great forests. They do not like storms, because they are not deep-rooted trees, and when a strong gale blows the spruce firs fall by the score. One tree fells another, and, like a row of dominoes, they crash down in the forest, making a broad alley through the wood. If we have a big storm this winter, look closely at the trees that fall, and you will be sure to see that some of them are spruce firs.

Our Christmas-tree is a *young* spruce, only a few years old. Plant it in the garden after you have used it for Christmas, stamp the earth down firmly, and maybe the tree will root itself in and grow.

We all try to have holly at Christmas-time, and the old custom began so many hundreds of years ago that we really are not sure how or why it started. From ancient times it was used to decorate our churches and our shrines, and it gets its name, holly, from the word holy. It has always been the holy tree. Another old name is the holm tree, and wherever the holly grew in woods it gave its name to the villages or countryside there. I have been to Holmwood, where there are

hundreds of beautiful holly trees, and you may be able to think of other villages to which the holly gave its name. Holmsdale and Holmbury are two more.

You know the holly so well that there is no need to tell you what it looks like. You have all seen its dark-green polished, prickly leaves, and the bright red berries that shine so brightly.

Have you seen the holly tree growing? You may see it as a hedge, a bush or a not-very-large tree. It is an easy tree to know because of its thousands of prickles. Why are they there? Most of you know, I am sure. They are to prevent animals from feasting on the leaves. Sheep and deer like the taste of the tough holly-leaves, so the tree has to find some way of protecting itself. No animal likes to hurt its tender tongue, so the holly is safe from greedy enemies.

At the top of the tree, out of reach of animals, are quite different leaves. They have no prickles at all. This is not very strange, is it? You can all guess the reason for that. Put a prickly leaf beside a smooth-edged one. You might think they had come from different trees!

You must look for the holly flowers in the spring-time. You will find them growing where, in the winter, the berries appear—tucked between the leaf-stalk and the twig. At the end of summer the faded flowers have gone and in their place are small green berries,

which turn to yellow and then to the bright red we know so well.

The mistletoe, which we hang up with the holly, is a strange plant. It is a thief, because it steals from other trees. Have you ever seen it growing? I have. Not far from my home is a group of black poplars, and in the winter-time, when the trees are bare, I can see strange-looking bundles high up in the branches. They look like tangled birds' nests, but they are mistletoe plants growing on the trees!

I will tell you exactly how the mistletoe starts its curious life. Perhaps one day a mistle-thrush finds an old spray of Christmas mistletoe thrown on the rubbish-heap. He is very fond of the pearly berries, so he feasts on them. The berries are sticky and the seeds inside stick to his beak. He flies up to a tree, and cleans his beak by rubbing it against a branch. Off he flies, leaving on the tree the seeds of the mistletoe.

Then the seed sets to work. It sends out a little root called a "sinker" right into the branch of the tree. This sinker is trying to get at the sap, because it wants to feed on it. When at last it reaches it, it steals it for its own use, and soon two small leaves appear on the bare branch. The mistletoe is growing!

More and more sinkers are sent down into the sap, and more and more leaves grow, until at last there is a big bush of mistletoe, its pale green leaves dotted

GATHERING MISTLETOE FROM AN ORCHARD TREE FOR USE AT CHRISTMAS-TIME

with half-transparent, pearly berries at Christmas-time. Because it steals from others, we call it a parasite—one who lives upon another. If we cut the whole bush away from the tree it will grow out again—for, without injuring the poplar-tree itself, we cannot cut out the sinkers that the mistletoe has sent down into the poplar's branches to steal some of the poplar's sap for itself.

You may find it growing on apple, lime, oak or black-poplar. Isn't it a strange plant?

As you know, trees that do not drop all their leaves in winter, and which we can therefore use for our decorations, are called evergreens. We have already spoken of three. Now let us make a list of some others. Who can think of the most? Privet, of course, laurel, ivy, box—what else? Yes, pines—and cypress, yew, juniper and cedar. Those who live on the south coast may add the bay-tree, too.

We all know the privet hedge which keeps green all the year through. But do you know the white flowers, which look rather like tiny white lilac sprays, but have a coarse, strong smell? We clip our hedges so much that usually our privets do not flower. If they do, we may see the purple-black berries now. Put some on your bird-table and see if the birds will eat them.

Up trees and over walls the ivy grows, clinging tightly to its support. Its stem cannot stand upright by itself, so the ivy must find something to help it. How does it manage to cling so fast to tree-trunks? If you tear away a bit of ivy-stem you will see scores of small white roots growing into the trunk. They are not like the sinkers of the mistletoe, because they do not steal the sap from the tree—they simply cling to it. But although the ivy does not steal sap, its leaves steal

light and space, and many a fine tree has died, choked by the strangling ivy. We should never let ivy creep up our trees.

Behind the thick, strong ivy leaves hide many little creatures—snails, flies, wasps and others. In their shelter are built many nests. Press back the five-pointed leaves and see how dry and sheltered the trunk or the wall behind is. When rain comes the drops trickle down from one ivy-leaf to another till they reach the ground—and in the ground you will find the ivy's real roots. Look and see.

IVY GROWING ON THE TRUNK OF A TREE

The laurel we know best is the big bush in the parks or shrubbery. It has big, tough, shiny leaves, and you will find dark purple berries among them. It is an ugly, gloomy plant, and seems to say to animals and children, "Keep off! I am poisonous!"

The true laurel is the bay, and you may have seen it made into arbours or arches, or grown in tubs as a tree or bush. Its leaves have a very fragrant smell.

You may know the Scotch pine by its curious

needle-like leaves, which grow in pairs, joined together at the base. Look for the old cones beneath the pines and see the woody scales behind which the winged seeds lay before the wind carried them away.

The yew you will often find growing in churchyards, and you will be surprised to see that its trunk seems made of dozens of little trunks, all growing closely together. From its wood were made the famous bows used by our soldiers before gunpowder was known.

You may never have seen the cedar, but you cannot mistake it when you do see it, for its branches spread out like flat, dark shelves, with big spaces between them. It grows to a very great age. You will find that the famous Cedars of Lebanon are mentioned in the Bible (1 Kings vii., 1–12).

THINGS TO DO

1. Draw a holly leaf. Draw a privet leaf.
2. Go and look under a holly-bush and find some "skeleton" leaves. Bring them to school.
3. Find some pine-cones or fir-cones and bring them to school to burn on the fire. They will smell nice.
4. Write down the names of six evergreens and the names of six trees which are not evergreens.
5. Draw a Christmas-tree with presents on and put underneath it its proper name. Look for a full-grown Christmas-tree next time you go for a walk.
6. Write down three things about the mistletoe.
7. Save some mistletoe berries at Christmas-time and press the seeds into crevices in the branches of apple, oak or black-poplar. Watch to see if they grow.

CHAPTER 7

THE ROBIN AND THE WREN

IN this chapter I am going to tell you about two more of our common birds—the robin and the wren. One you will have seen on your bird-table. The other you may never have seen at all, and yet he is as common as the robin, though not so friendly.

We will talk about the robin first. I hope that you have been looking at him carefully when he visited the food you put out for him. Did you see how bright his red throat and chest were? Did you notice the pretty blue line that ran round the red? Did you smile to see how bright and bold his black eyes were?

It is no wonder we like the robin better than any other bird, because he is so very friendly and tame with us. He is not very polite to his own world, for he does not care to mix with sparrows, thrushes, or chaffinches —or robins either for that matter! He likes to be with *us*. He enjoys himself thoroughly when we are gardening, because then he can eat the little worms or grubs our spade turns up. He will perch on the handle of the wheelbarrow, or sit on the watering-can—just to show us that he really *is* helping us and being friends. He bobs up and down, flicks his wings, hops to and fro,

and does everything he can to attract our attention. "I'm here!" he says. "I'm here! Just give me a chance and I'll be your very own robin!"

"I'M HERE!" HE SAYS

When autumn comes, and chill winds begin to blow, the robin chooses his winter home. Shall it be this garden, or that? Shall it be in the farmyard or in the lane? He makes up his mind, and then he sings a loud song, which says: "Oyez, oyez, this garden is my place, and no other robin is to come near, on pain of death or a fight!"

Perhaps another robin does come, and then there *is* a fight! Not much harm is done, usually, and the defeated robin flies away to find another winter home. Don't you think that it is quite a good idea really, for every robin to have his own "beat," and to find his own food there? Of course, other robins trespass now and again, but you will find that the one you see most

often in your garden is the same robin, day after day.

He will become very tame indeed if you will let him. If you put crumbs out on the same window-sill each morning, he will be bold enough to peck sharply on the window-pane if you forget ! He will come into the house if no cat frightens him, and will even take biscuit or bread from your hand or mouth if you keep still enough and are patient. I have often trained robins to do that, and people are so surprised to see it ! But anyone can tame such a friendly creature if only they will try.

When spring comes the robin finds a wife, and how he sings to her ! Have you heard the robin singing? He is singing beautifully now, for he is one of the birds that sing nearly all the year round. His song is very rich and creamy and quite loud. Once you have heard him and seen that it is a robin singing you will always be able to know his song.

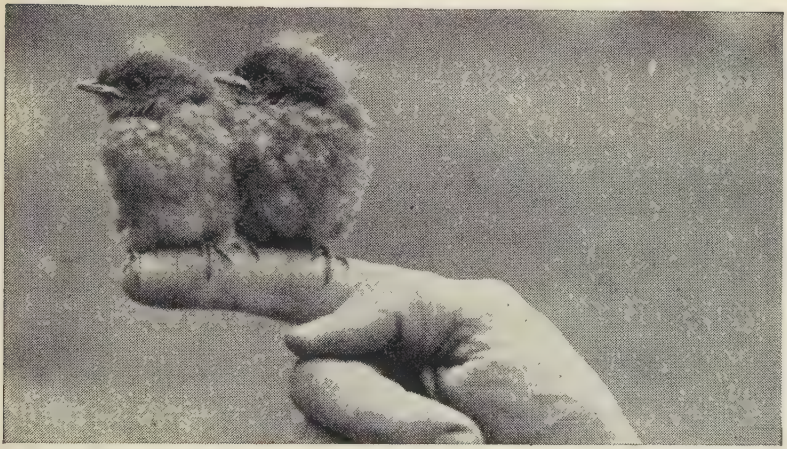
In spring he and his wife hunt for a good nesting-place. Where shall it be? Somewhere low down, for the robin prefers to nest near the ground. If he can, he likes to put his nest into something that belonged to his great friend, Man. If he can find an old kettle or saucepan, a rusty tin, an old worn shoe, he will choose it with delight. One robin built his nest in the hat on a scarecrow's head ! Sometimes he will build it

[*Eric Hosking.*

A ROBIN'S NEST IN AN OLD WATERING CAN

on a shelf in an outhouse of ours. It isn't near the ground, but it belongs to us, his friends. If he finds nowhere really suitable of that kind, he will choose a bank or a hole in the wall.

He builds rather an untidy nest, but a very comfortable one, with plenty of dead leaves and moss to make it soft and warm. If there are dogs, cats or cattle near, the robin hunts for their cast-off hairs and weaves those into his nest, too. Then his wife lays five or six



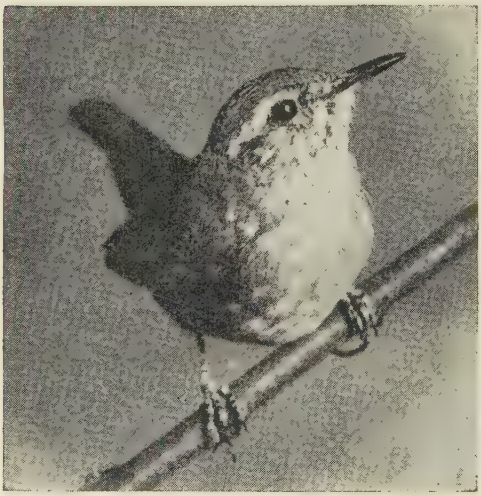
TRY TO TAME THE ROBIN IN YOUR GARDEN. HE IS LONGING TO BE AS FRIENDLY AS THIS!

greyish eggs, freckled with dull red, and sits on them. When they hatch they grow into pretty little fledglings with speckly brown breasts, not red ones. They will not get their fine red waistcoats until the following spring. Did you know that? If you see a robin-like bird in your garden with a speckly vest instead of a red one you will know it is a *young* robin.

When autumn comes again the family splits up, for the father robin knows there will not be enough food in one small place for so many beaks. This means many fights, of course, for the children want to stay in the spot they know. But soon all are settled somewhere and are eager to make friends with the people near by.

Tame the robin in your garden if you can. Take

crumbs in your pocket and throw them down when you see him. Though he is shy at first, he is longing to have a human friend, so don't disappoint him!



HERE IS STUMPY—THE WREN—A LITTLE BIRD WITH A VERY BIG VOICE

We do not see the wren half so often as we see the robin—but he is somewhere about, all the same! He doesn't care a bit about us; he doesn't want to be friends, and he doesn't even seem to notice us! Have you seen him? In the north he is called Stumpy, and it is a very good name for him, for he is small and has a stumpy little tail, which he always wears cocked up in a very perky manner.

He is a little brown bird, smaller than a sparrow, with rounded wings and a sharp beak, and he is barred all over with dusky stripes, as you will find if you see him at close quarters.

He does not come out into the open and attract our attention as the robin does, nor does he bother much about the bird-table. He likes to hunt in all the nooks

and crannies forgotten by the other birds. He creeps behind the ivy leaves, he squeezes into the thatch, he searches every corner of the wood pile, and as his hunting takes him so often into these hidden places we do not see him as much as we might. You may think he is a mouse sometimes, when you see him creeping rapidly from place to place!

Although he is very small, he has a most enormous voice. To hear him sing you might think he was as big as a rook! His song is very clear and ringing, and almost sounds as if it were a challenge to other birds, it is so bold and defiant. He always ends it with a few very loud ringing notes. You cannot mistake his song once you have heard it, and I am sure you will be astonished to see what a small bird it is that is singing such a torrent of loud notes. When he is angry or frightened he makes a queer grating sound, as if he were winding up a big clock.

The wren loves to make nests. One little wren here at my home is always making them, just for fun. I cannot think of any other reason! Do you know where it makes them? In the thatched roof of my cottage! I really couldn't tell you how many wrens' nests there are there—some just little holes, some with a bit of lining made of moss, and one or two quite finished. The last nests have been used for eggs, and were made properly and lined beautifully. The wren visits all his other funny little nests occasionally. I see him popping in and out of them, as busy as can be.

In winter he roosts in one, cosy and warm. His real nest, the one used for eggs, is made of something near by —leaves, moss or dry grass, for instance. He tucks

A WREN FEEDING HER BABIES

these into the hole he has chosen in the thatch (or in a stack, tree-trunk, wall or bush) and lines the nest softly with hair or feathers. His tiny wife lays a big cluster of eggs there—sometimes as many as eight or more—and then sits patiently until they hatch.

The wren does not mind his nest being easily seen. Last year my little wren built in the thatch directly over the garden door, on the sill of which my two cats sat every day. When the eggs hatched, and the tiny nestlings could see, they would peep out of the nest each time anyone came in and out of the door, but they were not a bit afraid. They flew off safely, and are still about the garden, grown-up now, as busy as their parents, and as loud-voiced. Sometimes two or three sing at once, and I can hardly hear myself speak !

The eggs are white or may be slightly speckled.

The wren eats a lot for his size. He likes spiders, small insects, chrysalids, and in the winter-time he will eat seeds. He is not so ready to eat crumbs, potatoes, and the other things we put on the bird-table—which is why we seldom notice him there.

I hope you will see him soon, if you have not already made friends with him. If you hear a loud song in the garden, with a trill in it rather like a canary's, rush out to see if you can spy the singer—it is sure to be a wren !

THINGS TO DO

1. Write down two things about a wren.
2. Write down two things about a robin.
3. Look closely at a robin next time you see one. Remember his colours, and draw one and colour him.
4. Draw an old saucepan. Put a nest inside with four eggs. Draw the robin standing near.
5. Try to tame the robin in your garden.

CHAPTER 8

FOOT-WRITING IN THE SNOW

EVERYBODY has seen foot-writing in the snow—the prints made by feet as they walk, jump or run. Perhaps you, if you live in a town, have not seen many prints. You have seen human tracks, the prints of horses' hoofs, and those of cats and dogs. Those who, like me, live in the country, can see many more. There are fox tracks, rabbit and hare prints, the foot-marks of pheasant, partridge, moorhen, coot, thrush, blackbird and many other birds. There are rat-tracks, weasel and stoat prints, and even, if we are *very* lucky, the big marks of the broad-footed badger.

We will let all the different creatures describe their own foot-writing, and tell us why their prints differ so much from one another in shape and position. The dog shall have the honour of speaking first.

The Dog's Foot-Writing

I walk on my toes, so, if you look in the snow (or in the mud, either, for that matter !) you will see only the imprint of my four sets of toes. You know, don't you, that I cannot draw in my claws as the cat does,

so you will find that I have left a print of my claws as well. My track is not very neat. Sometimes I leave big prints and sometimes small. It depends what sort of a dog I am! You will find that if I walk on hard, crisp snow my prints are smaller than on yielding snow, because then I have to spread out my toes well to keep a firm hold. Please give your dog a run in the snow, and find out just what tracks he leaves.

THE CAT'S TRACKS

I am a neat walker, and as I must hunt my prey in silence, I am very careful where I put my feet. I like to put my hind feet in the same place as I put my fore-feet, so if you look at my snow-writing you will usually see that my tracks are in a single line. If I run, you will see my tracks in pairs, because I go bounding along then, front feet close together, and hind feet close together.

You will not see my claws in my prints because I take too much care of them to allow them to rub against the ground, as the dog does. I draw them closely into their sheaths, and so keep them sharp-edged.

THE HORSE

I cannot very well show you my real foot-print, because I have to wear iron shoes, so you will only

see the tracks of those in the snow. If you could see my prints without my shoes, you would see that my hoof is all one—not split in two like the cow's.

THE FOX'S NEAT WRITING

I am as neat a walker as the cat, because I too hunt silently and stealthily, and, like all animals who hunt quietly, I place my hind feet in the same spot as my fore-feet. It is sometimes difficult to tell the difference between my writing and the cat's—but if you look at my track carefully you will see the marks of my claws. I belong to the dog family, you see, so I cannot draw in my claws, but, like the dog, allow them to scrape the ground. There is another way in which I show that my track is mine. I have a fine tail, bushy and thick, and sometimes, when I stop to sniff the air, I let it brush the ground. It leaves its trace, and, when you see it, you can say—"Ah, a fox passed here!"

THE RABBIT'S PUZZLING TRACK

On the snowy hillside or over the white meadows you will see dozens and dozens of my foot-marks. I do not sleep in the winter, you know, and even on the coldest morning I come out to look for food. It may be that I can find nothing except perhaps a bit of ivy-bark to

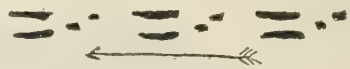
YOU CAN TELL THE DIFFERENCE BETWEEN THE TRACKS OF A FOX AND A CAT, BY THE MARKS OF THE FOX'S CLAWS

gnaw. You will see my foot-prints all mixed up with those of my brothers and sisters. When you find a single track you will be sure to make a mistake about the way I am going, for I leave rather a puzzling trail.

My little front feet are placed close together when I run, and my big, strong hind feet you will see printed long and deeply in the snow—but, when I travel, I always place my hind feet *right in front of my fore feet*! and therefore, when you see my track, you think I am

going in the opposite direction to the one I really took. Isn't that queer? Look at the picture of me running away in fright. Then you will see how I place my hind feet in front of my fore feet.

THE HARE AND HIS PRINT



My foot-print is rather like that of a very large rabbit, because I am much bigger than my cousin. You will not find my foot-prints all mixed up with others, for I do not like living with a crowd. I prefer to be alone. I run alone, and my tracks are clear to see and follow. They are bigger than a rabbit's, and there is a greater distance between them, for I bound farther when I travel. You will find, too, that I do not turn my feet out quite so much as my cousin does.

THE STOAT'S QUEER TRAIL

I leave the neatest track of any animal. It is rather like a chain of small round holes in the snow, and you may well wonder how I leave them. I will tell you. Like the cat and the fox, I hunt quietly by stealth, and I put my hind feet in *exactly* the same spot as that in which I placed my two little fore feet. Scrape the snow gently away from one of the little holes and

THE SNOW-TRACK OF A FRIGHTENED HARE, WHICH HAD HURRIED ALONG IN RUSHING LEAPS

look at it closely. You will then see the marks of four tiny feet, all bunched together! When I walk you will see the prints opening out a little, but walking, running, or leaping, my foot-writing is always very neat, and deserves, I think, full marks!

The Squirrel's Feet

I like to sleep most of the winter—but I wake up sometimes to have a feast. Then you may see the marks of my long-toed feet quite clearly in the snow. You know, I expect, that I have small front feet, in which I like to hold my food, and big hind feet to help me to

bound along. I do not put my hind feet in front of my fore feet, as the rabbit does, but a little way behind them.

The Rat's Writing

I know nobody likes me, but I don't care, for I am fierce and savage. I leave a track rather like four little hands. There are four fingers on the front paws, and five on the back ones. Sometimes I leave the print of my long tail, too. If you find a track of me walking you will see that the prints are in pairs—a little front foot beside a big hind foot all the time. But if I run you will find all four feet in a straight line, with the little fore feet inside the big hind feet.

The Badger's Big Feet

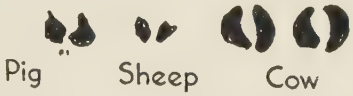
You will know my track when you see it, for I leave big prints, with the claws clearly marked at the tip. My fore feet always point straight forward, but my hind feet turn in badly. I am afraid I walk in a shambling way, like a bear. If you are ever lucky enough to see my foot-prints, you will find that my hind-prints spoil my front ones by over-lapping them.

Please find a picture of me. I am really rather a nice creature.

THE SLEEPY HEDGEHOG

It is a bother to wake up in the winter, so I usually try not to—but if I do I write in the snow like any other animal. I have such short legs, though, that generally my body brushes against the ground as I walk, and destroys the foot-prints I make. My feet are long in shape, and in my foot-prints you may see the marks of my claws at the tip.

THE COW, THE PIG, THE SHEEP, THE DEER



We can all speak at the same time, for we all show hooves split in two. We call them cloven hooves.

THE MOORHEN'S FOOT-MARKS

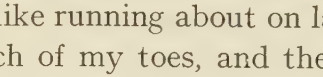
You will not be able to tell which print is made by my right foot and which by my left, when you look at my snow-tracks, for I place each foot exactly in front of the other. I swim on water, and run on land, so, in order to run quickly, I have long, strong toes, not webbed. Have you seen me swimming? I bob my

head in a sort of clockwork manner, and this is because I have to push so hard with my unwebbed feet when I swim that my head is jerked forward with my efforts! I put my feet one in front of the other when I walk, because as my path lies often through weeds and mud, it is easier to walk like that than putting them first to one side and then to the other.

The Coot

Like my cousin, the moorhen, I can swim and dive—but unlike him I do not like running about on land. I have grown lobes on each of my toes, and these help me in my swimming. If the ponds get frozen over I have to leave them and go to the rivers, where there is running water. But sometimes I am taken by surprise, and find my pond so suddenly frozen that I am driven to the banks—and then you will find the fiddle-shaped marks of my curious toes! Can you find a picture of me and the moorhen?

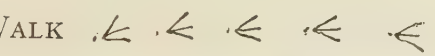
Birds that Live in the Trees



We tree-birds, such as the chaffinch and the sparrow, always hop, so you will find our foot-prints in pairs. You see, we are so used to jumping from one twig to another that when we are on the ground we still jump,

or hop, with our feet close together! Look for our marks round your bird-table.

Birds that Walk



You know us well, for you have seen us often. We are birds like the pigeons and the starlings, and we do not hop. We are really more at home on the ground than in the trees, so we walk. You will find our foot-writing quite easily, one print alternating with another, with sometimes a pair close together to show you where we stood still.

* * * * *

Now that the animals and birds have told you all about their foot-writing, go and see it for yourself as soon as the snow covers the ground. Take a walk and see how many of the different writings you can read.

THINGS TO DO

1. Let your dog or your cat out in the snow and see their foot-prints. Draw them.
2. Go out into the snow yourself. Walk. Run. Jump. Notice how different your three tracks are.
3. Write down the reason why a cat does not show her claws in her snow-tracks, and why a dog does.
4. Pretend you are a sparrow. Explain your foot-prints and draw them.
5. Take a note-book and go to the bird-table, if your school has one. Draw in your book some of the snowy-tracks you see around it. If you have no bird-table, walk out in the snow, and then draw your own tracks.

CHAPTER 9

TWIGS AND THEIR STORY

ALL through the autumn we saw the trees changing colour as their leaves glowed yellow, orange, purple, red or pink. Then, one frosty morning, down the leaves fell in hundreds and the trees began to look bare. More frost and a big wind took the rest of the leaves away, and now, when we look out of the window, we see strong, bare branches and a multitude of little twigs laced against the sky—but no leaves. Only the dark evergreen trees, whose leaves never change colour, stand dressed in foliage. All the other trees are bare.

Do you know why the trees drop their leaves and strip their twigs so bare? There is a most interesting reason for this. Perhaps you didn't know it, but leaves have a great many little holes over their surface, called *stomata*, and through these holes the water in the leaf evaporates very quickly. This is a good idea in the summer, when the roots can take up the water in the soil and send it in plenty up to the leaves—but in the winter, when the ground is frozen and the roots cannot take up water, the leaves would be very wasteful of moisture, just when the tree needed to be careful.

"Very well!" we can imagine the tree saying, "I will get rid of my leaves in the winter-time! Then

they cannot evaporate away what little water I have! I will grow new leaves when the warm weather comes."

And that is just what the tree does! It throws off all its water-wasting leaves, prepares new ones tightly wrapped up in buds, and waits for the spring. Whilst it is waiting it is resting. It does no work, but treats the winter as a long night and sleeps soundly.

You may wonder how it is that the evergreen trees do not drop their leaves in the autumn, too. Take an evergreen leaf in your hand and feel it. Isn't it hard and tough! A holly leaf, with its waxy toughness, is quite difficult to tear. As for the pines, why they have leaves more like needles than leaves! They have done away with the large leaf surface, and, so that they cannot lose much water, have made their leaves as small and thin as possible. Only by tough, thick leaves, or needle-like leaves, can trees prevent a great loss of water in the winter-time.

But the leaves of other trees are thin and delicate, and, having a large surface, they lose a great deal of water. So off they go in the autumn, leaving behind them the buds of new ones.

How does the tree arrange to send them away? You would never guess! I expect you know that the tree has thousands of little sap-tubes or water-pipes, through which it sends moisture up to the leaves.

Now when the autumn comes and the leaves are to

fall, the tree carefully stops up all the water-pipes leading into the leaf-stalk! It grows a layer of cork over them, and after a time no water can pass into the leaves. You know what happens to leaves if you put them into a vase with no water, don't you? They dry up and die.

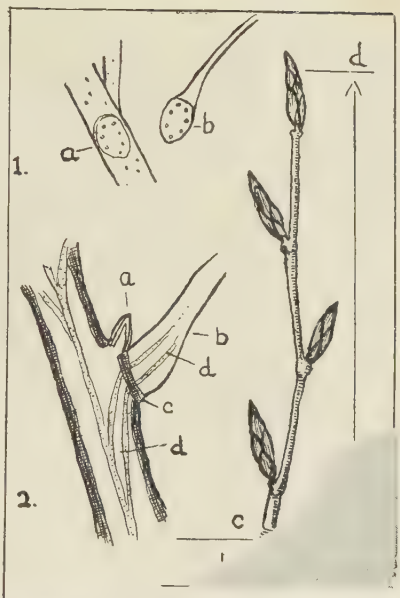
That is what happens to the leaves on the tree. They begin to dry up, and, as the cork layer separates them from the twig, they are ready to snap off at a touch. Down they go, leaving a scar on the twig to show where once they grew. The scar not only shows the size of the leaf-stalk and the shape of its base, but also the little stopped-up ends of the water-pipes.

Take a horse-chestnut twig and look at it. Do you see the horseshoe-shaped scars there? That is where the leaves fell off this autumn. They were big leaves on big stalks, so they left big scars—and those little dots that look like the nails in the horseshoe are the stopped-up water-pipes! Each nail is a little bundle of pipes. If we could see the leaves that fell off, and could look at the bottom of the leaf-stalk, we should see the same pattern of nails there, too! They show where the water-pipes entered the leaf.

How do the leaves get their lovely colours before they fall to the ground? They get them in a curious way. The tree uses its leaves in autumn as a sort of dustbin and sends to them a great deal of

waste-matter that it wants to get rid of. It is this rubbish that paints the leaves so brilliantly! But although it is waste-matter to the tree, it is of value to the soil, and gardeners keep the dead leaves to make leaf-mould, which is of great use in the garden.

Have you some beech-twigs there? Pass one or two round and look closely at the places on the twigs where you can



SLOWLY OPENING. GET SOME THEM IN YOUR SCHOOLROOM

goes on the stalk gets longer and longer, until when autumn comes it may be six or eight inches long! It is a little twig in itself—and it all came from that one tiny bud.

Now if each bud does this you can quite well see how trees grow broader and taller each year. And, as each spring the bud-scales leave the bud-scars we spoke of, you can easily see the growth made from one year to another by looking at the space between the bud-scars. Look at a twig now and measure the space.

Look at the top bud of your beech-twig. Do you see how well it is wrapped up in many scales of brown? When the warm days come those scale-leaves will loosen and open. One by one they will fall off all round the bud—and as they fall they will leave a scar to mark where they grew. When they have all fallen off we shall see a number of little rings all round the twig—the bud-scar, marking where the bud-scales grew.

Look at the different twigs you have, and find the leaf-scars and bud-scars there. Some twigs, like those of the horse-chestnut, have very big leaf-scars. Some, like the beech, have small ones because their leaves also fall. The *bud-scars* always circle the stem.

Take a know how a bud grows into a twig? Per- see the horse- guess that each bud on a tree grows the leaves fell off this year that only a leaf came out! on big stalks, so they left big scars—and those little dots that look like the nails in the horseshoe are the stopped-up water-pipes! Each nail is a little bundle of pipes. If we could see the leaves that fell off, and could look at the bottom of the leaf-stalk, we should see the same pattern of nails there, too! They show where the water-pipes entered the leaf.

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A SYCAMORE TWIG WITH ITS BUDS SLOWLY OPENING. GET SOME AND WATCH THEM IN YOUR SCHOOLROOM

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In the summer-time when all the trees are green with leaves, you may find the little new buds for next year on the twigs! You will see them lying snugly between the leaf-stalk and the twig, and this is about the most sheltered place they could have. In the autumn the leaves fall, leaving a scar, and above the scar sits the new bud, patiently waiting to grow bigger.

But the cold days are ahead, and the tree sleeps. No work is done, no growth is made. The bud waits. The frost comes and the rain comes. How is it that they do not kill the tender young bud?

They cannot harm it because it is covered up with thick waterproof scales, and is often protected beneath the scales by soft wool or warm down. Look at your horse-chestnut bud. Do you see the thick brown scales covering the bud? Touch them. Are they sticky? The gum prevents the rain from harming the leaves hidden beneath. Pull off the scales. What soft woolly coverings there are underneath, keeping the young leaves warm and safe!

Someone else finds the sticky gum outside the buds useful besides the young leaves. The bee hunts for it in the early spring to use for stopping up any holes or cracks in its hive. There is always a faint humming among the horse-chestnuts as soon as the weather gets warm and the bees are out seeking gum. Listen for it this coming spring.

If you take off the outer coats of the bud you will

HAVE YOU ANY HORSE-CHESTNUT BUDS LIKE THESE? THEY ARE JUST BEGINNING TO OPEN

find the minute green leaves tucked away inside. They are folded very carefully in all kinds of different ways. The beech pleats its leaves like a fan. The horse-chestnut folds its leaflets into two, like sheets of note-paper. The pear rolls its leaves up very neatly from the outer edge to the mid-rib. All the trees have good ideas to save space in the bud.

You should be able to recognise a few trees in winter, even though there are no leaves to guide you.

1. The horse-chestnut you know well, because of its big fat buds with their sticky coats.

2. The ash has stout black buds, very solid-looking, arranged in pairs.

3. The beech has thin, pointed buds, arranged singly and alternately down the stem.

4. The lime has small, rounded buds, ruby-red.

5. The oak has a rather untidy twig, with a cluster of buds at the end, a few down the stem and then another cluster of brown buds.

6. The sycamore has a big green bud at the top, and a number of smaller buds down the sides.

7. The elm has a number of tiny buds, and along the twigs you will find different buds, more bead-like, which contain the flowers.

8. The plane has reddish-brown buds, which are protected in a clever way before the leaf falls. The base of the leaf-stalk fits exactly over the bud, and inside the stalk the bud remains safe and sound all the summer until the leaf falls off and reveals its secret. By that time the bud is big enough to look after itself.

THINGS TO DO

1. Find as many twigs as you can. Find out their names and put them in little jars on the Nature table to watch them come out. Put their names on the jars.
2. Draw a horse-chestnut twig. Draw a beech twig.
3. Write down how it was that your horse-chestnut twig came to have its horseshoe-shaped scars.
4. Write down the way in which a twig grows from a bud.
5. Find some twigs to keep at home in a jar. Change the water each week. Take them to school to show the others as soon as they begin to open.
6. If you have any clay, model one of your twigs in it.

CHAPTER 10

THE FRIENDLY TITS

THERE are a great many different kinds of tits, but I am only going to tell you about the three you are likely to know well—those that come to our gardens or to our windows. What are their names? Some of you will know them, I am sure! The Great-Tit or Ox-eye is one, the Blue-Tit or Tom-Tit is another, and the third is the little Coal-Tit, the smallest of all and the least common.

The proper name for the tit family is Tit-Mice! It seems a queer name, doesn't it—but a very good one if you think of the habit the tits have of running up the tree-trunks and along the branches like tiny mice!

The tits are the acrobats of birdland. They don't mind whether they are hanging the right way up or head downwards; they are so agile they can perch on the tiniest foothold, and they swing themselves about in all sorts of positions as they feed. No other bird is quite so acrobatic. If the birds ever held a circus of their own the tits would certainly get the most applause!

All three tits are fearless and friendly. They will swing on a coconut just outside our window, and let us watch them at any time. They will live in our

gardens all the winter if only we will provide for them the food they like. They will not feed from our hand as the robin will, but they are quite ready to fly down to a bone we have hung up, almost before our hand has left the bone!

They are pretty, dainty birds, delightful to watch and to know. I will tell you the difference between the three of them, so that you can watch for each and recognise them when they come.

As his name tells you, the Great Tit is the biggest of the three, about the size of a sparrow. He is a smart, glossy bird, dressed in yellow, black and green. His head is a shining blue-back, very dark, and down his breast runs a deep black stripe, by which you may always know him. He has a strong beak and bold, bright eyes.

I am sure you have heard his loud call, especially in the springtime. It is two notes, see-sawed up and down, and they sound like "*Pee*-ter, *Pee*-ter, *Pee*-ter, *Pee*-ter, *Pee!*" It is a rasping sound, and has earned him the queer name of Saw-sharpener! Play the sound on the piano—high G, E, high G, E—a few times, and sing "*Pee*-ter" as you do it. Then you will soon know what sort of call he makes.

He also says, "Pink! Pink!" very loudly, rather like the chaffinch. He has a trilling song, too, that sounds like "tzoo-tzoo-werry, tzoo-tzoo-werry, tzee-

TITS AT PLAY

tzee!" You will have to listen to him carefully whenever you can, and you will soon get to know his imperious little voice.

The Blue-Tit is my favourite of the three. He is such a fearless, excitable, gallant little bird, full of life and as sharp as a needle. You may know him by his blue cap encircled with white, and his green, blue and yellow dress, and small size. Look for his blue cap, from which he gets his name, and you will be able to recognise him at once. His beak is not so strong-looking as the Great-Tit's, but he does very hard work with it, all the same, pecking great pieces of coconut out, and chipping away at monkey-nuts and bones!

He is a most excitable, pugnacious little creature. When he finds a new coconut hung up, or sees that I have put a fresh supply of nuts in the pea-nut feeder, he calls loudly to all his friends to tell them the great news—and then, when they come to feast too, he scolds them vigorously, raising up the blue cap on his head until it looks like a crest, and flies angrily at the newcomers!

He can't keep the *news* to himself, but he wants to keep the *food* for himself, the funny little creature. Many times a day I look out of my window and hear an excited churring of tits, and see two fall to the ground, pecking one another in a great rage. Not

[*Eric Hosking.*

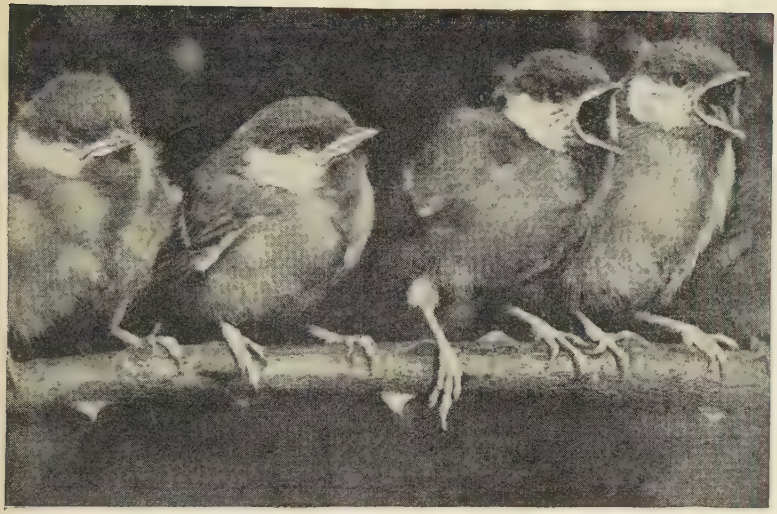
THIS BLUE-TIT HAS CHOSEN A BROKEN DRAIN-PIPE FOR HER NEST

much harm is done, but oh, what an excitement it
world of tits!
erhaps the best acrobat of the
monkey-nut on a long thread,
to the little nut, catch
pecking away
thread.
He
l

One of the commonest noises in the springtime round about my cottage is the call of the Blue-Tits. "*Pim*-im-im-im-im! *Pim*-im-im-im-im!" they cry to one another, the *Pim* two notes higher than the rest. Sing it yourself, and you will hear what it sounds like. Keep your teeth closed whilst you make the sounds. When the tits begin to call in the springtime you must listen hard for them. It is such a lovely feeling when you hear a bird calling, and can say, without seeing it, "Oh, that's a Blue-Tit!" or "That's a Wren!"

The Coal-Tit is the smallest of the three common tits. He has a coal-black head, and down the nape of his neck you will see a white streak. By this you may know him, so look out for that. His colouring is not so bright as the others. He is more greyish, duller altogether. He looks as if he wanted a "wash and brush-up." But he is a dear little bird [illegible] as the others, and almost as fear[illegible]

His call is very much like [illegible] other way round. The G[illegible] the high note—*P*[illegible] it on the [illegible] if-*fe*[illegible]



"PLEASE MAY WE HAVE SOME DINNER?" A HUNGRY FAMILY OF GREAT-TIT NESTLINGS

do for them. They fill the hole with soft material such as moss, leaves, or grass, and line the nest with hair, feathers, rabbit fur, and cobwebs.

They lay a large number of eggs, often more than a dozen; the eggs are all much alike save that the Great-Tit's are bigger. They are white with red spots. The birds sit closely on their eggs, and if anyone puts his hand into the hole where the nest is built, the tits hiss like snakes, and peck viciously at the intruder's hand.

Tits often roost at night in ivy and evergreens, but if you like to put out old coconut shells, flower-pots

hung against the wall, or a box with a hole in it you will perhaps find that they are occupied by tits during a cold night!

All three tits do a great deal of good, for they eat millions of grubs and caterpillars each year. They sometimes damage the fruit-buds by searching for grubs inside, but the good they do far outweighs the harm. It is said that in one day a couple of tits feeding their young ones may take as many as one or two thousand grubs to them.

Try to rear a family of tits in your own garden or school garden. If you put out a nesting-box in the right position and watch carefully, you are sure to see the tits peeping into it, trying to make up their minds to live there! And what fun it is when they build inside your box and you have the joy of seeing a large family of fluffy yellow tit-babies rushing about all over your garden.

THINGS TO DO

1. Hang up a string of monkey-nuts in your garden.
2. Write this down—"The Great Tit has a black head and a black streak down his breast. The Blue-Tit has a blue cap, and is smaller. The Coal-Tit has a coal-black head and a white streak on the nape of his neck. He is the smallest."
3. Listen for the tits' calls, learn them and whistle them back to the tits whenever you hear them calling.
4. Draw a coconut hanging up and tits flying round.

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